

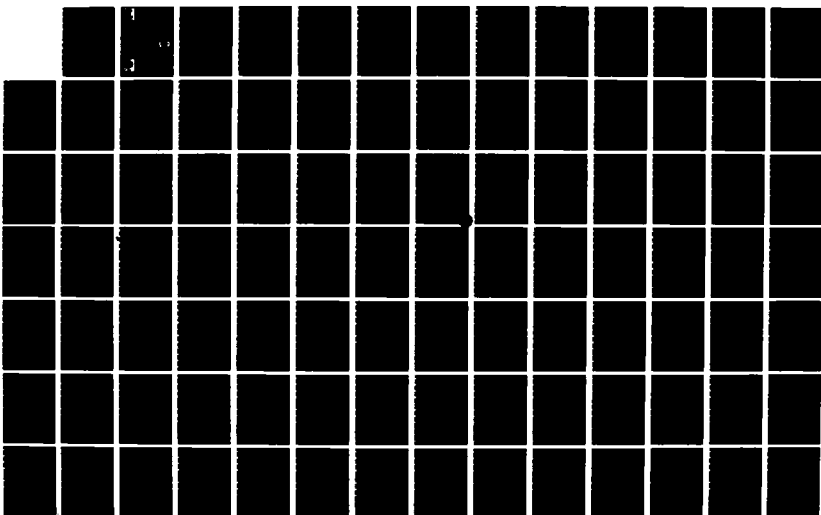
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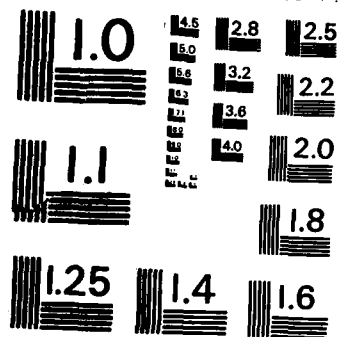
MISSISSIPPI RIVER PASSES PHYSICAL MODEL STUDY REPORT 2 1/2
SHOALING AND HYDRA. (U) ARMY ENGINEER WATERWAYS
EXPERIMENT STATION VICKSBURG MS HYDRA.

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TECHNICAL REPORT HL 86 1

MISSISSIPPI RIVER PASSES PHYSICAL MODEL STUDY

Report 2 SHOALING AND HYDRAULIC INVESTIGATIONS IN SOUTHWEST PASS

Hydraulic Model Investigation

by
Howard A. Benson, Robert A. Boland, Jr.

Hydraulics Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Report HL-86-1	2. GOVT ACCESSION NO. AD-A166 777	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MISSISSIPPI RIVER PASSES PHYSICAL MODEL STUDY; Report 2, SHOALING AND HYDRAULIC INVESTIGATIONS IN SOUTHWEST PASS; Hydraulic Model Investigation		5. TYPE OF REPORT & PERIOD COVERED Report 2 of a series
7. AUTHOR(s) Howard A. Benson Robert A. Boland, Jr.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Engineer Waterways Experiment Station Hydraulics Laboratory PO Box 631, Vicksburg, Mississippi 39180-0631		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Engineer District, New Orleans PO Box 60267 New Orleans, Louisiana 70160		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE January 1986
		13. NUMBER OF PAGES 179
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Available from National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Banks (Oceanography)--Mississippi River (LC) Channels (Hydraulic engineering) (LC) Hydraulic models (LC) Mississippi River, Southwest Pass--models (LC)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Maintenance of Southwest Pass, one of the three major outlets of the Mississippi River, is a continuing and expensive problem due to extensive shoaling, primarily near the ends of the jetties and, to some extent, throughout the entire length of the pass. This report and Appendix A present the results of the model studies conducted to determine the effectiveness of proposed plans (e.g., lateral spur dikes, sediment diversion channel, (Continued)		

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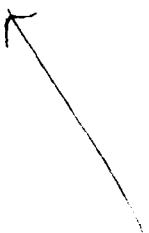
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20. ABSTRACT (Continued).

sediment basin, relocation of the jetty channel, lateral spur dike extensions, and friction chambers) for the elimination or reduction of maintenance dredging in Southwest Pass and in the jetty and bar channels.

Results of tests of Report 2 and Appendix A indicate some slight reductions in overall channel shoaling. Most of the test results indicate that there would be a redistribution of the shoal material in Southwest Pass; however, none of the plans tested caused movement of a significant quantity of shoal material into the Gulf.



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PREFACE

The model study reported herein was requested by the Commander, US Army Engineer District, New Orleans, and was authorized in February 1971.

Construction of the model was accomplished during the period January 1973 to November 1973. Verification of the model and Head of Passes testing for both hydraulic and shoaling tests were conducted from November 1973 to August 1976. Shoaling and hydraulic tests for Southwest Pass were conducted from August 1976 to January 1980. This report describes the problems that necessitated the model investigation, the model, the appurtenances, the tests conducted, and the results of those tests.

The study was conducted in the Hydraulics Laboratory of the US Army Engineer Waterways Experiment Station (WES) under the general supervision of Messrs. H. B. Simmons and F. A. Herrmann, Jr., former and present Chiefs of the Hydraulics Laboratory; R. A. Sager, Assistant Chief of the Hydraulics Laboratory; R. A. Boland, Jr., Chief of the Hydrodynamics Branch; G. M. Fisackerly, Research Group; and H. A. Benson, Project Engineer, Hydrodynamics Branch. Previous Project Engineers on this study were Messrs. W. H. McNally, Jr., and J. V. Letter, Jr. Technicians of the Estuaries Division who assisted in the investigations included Messrs. J. T. Cartwright, J. Cessna, C. R. Holmes, P. E. Cunningham, Jr., E. A. Frost, B. Kearns, B. G. Moore, and D. Marzette. This report was prepared by Messrs. Boland and Benson and edited by Mrs. Beth F. Vavra, Publications and Graphic Arts Division.

Director of WES was COL Allen F. Grum, USA. Technical Director was Dr. Robert W. Whalin.

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CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
cubic feet per second	0.02831685	cubic metres per second
feet	0.3048	metres
miles (US statute)	1.609347	kilometres
square feet	0.09290304	square kilometres

MISSISSIPPI RIVER PASSES PHYSICAL MODEL STUDY

SHOALING AND HYDRAULIC INVESTIGATIONS IN SOUTHWEST PASS

Hydraulic Model Investigation

PART I: INTRODUCTION

Background

1. Maintenance of Southwest Pass, one of the three major outlets of the Mississippi River, is a continuing and expensive problem due to extensive shoaling, primarily near the ends of the jetties and to some extent throughout the entire length of the pass. Most of the shoaling in the jetty channel occurs during times of high freshwater discharge. This report (Report 2) presents the results of the model study conducted to determine the effectiveness of proposed plans (e.g., lateral spur dikes, sediment diversion channel, sediment basin, and relocation of the jetty channel) for the elimination or reduction of maintenance dredging in the jetty and bar channels. A similar study on the relocation of the jetty channel was conducted during the period January 1957-June 1959.*

Purpose

2. The primary purposes of the model study were to develop and evaluate plans for reducing channel shoaling in Southwest Pass of the Mississippi River.

Scope

3. This report contains the results of tests to reduce channel shoaling between miles 10 and 15 and in the entrance channel of Southwest Pass and the

* H. B. Simmons and H. J. Rhodes. 1965 (Aug). "Plans for Reducing Shoaling, Southwest Pass, Mississippi River; Hydraulic Model Investigation," Technical Report 2-690, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

effects of these plans on the entire system. Several series of tests were conducted involving the addition of lateral spur dikes on the left descending bank of Southwest Pass and the extension of some existing spur dikes on both banks for the reduction of clear width between the ends of the dikes. The lower Southwest Pass test involved the addition of a sediment diversion channel, a sediment basin, and an alternate plan for constructing a new entrance channel through the left descending bank. A report on additional studies of spur dikes and friction chambers is included as Appendix A.

PART II: PROTOTYPE

4. Southwest Pass, one of the three major outlets of the Mississippi River, is the principal navigation channel between the Gulf of Mexico and New Orleans, La. (Figure 1). At the time of the study reported herein, Southwest Pass was being maintained to provide the authorized navigation channel 40 ft* deep by 800 ft wide from Head of Passes (HOP) to about mile 18 below Head of Passes (BHP), and 40 ft deep by 600 ft wide from mile 18 BHP to the entrance channel in the Gulf. The navigation channel above HOP has a width of 2,000 ft and natural depths greater than 40 ft. The length of Southwest Pass is approximately 20 miles from HOP to the tip of the jetties.

5. South Pass, approximately 13.5 miles long, is the second major outlet for navigation to New Orleans. The navigation channel was 30 ft deep by 400 ft wide from HOP to the jetties during the model studies presented. In the prototype, the last maintenance dredging in South Pass was completed in 1978. The lower reach of the channel has shoaled to a 17-ft depth.

6. Pass a Loutre, the third major outlet in the system, has natural depths of about 25 ft at HOP and shallows to about 6 ft at the outer bar. Pass a Loutre is approximately 17 miles long from HOP to the Gulf.

7. There are three additional outlets in the Passes area called Baptiste Collette, Grand-Tiger Pass, and Main Pass. Baptiste Collette and Grand-Tiger Pass are located about 10 miles above HOP and Main Pass is about 3 miles above HOP.

8. Flow distribution through the Passes, based on 1974 flow measurements taken from the US Army Engineer District, New Orleans, Deep Draft Report,** shows Baptiste Collette with about 4 percent; Grand-Tiger Pass, 5 percent; Main Pass, 11 percent; South Pass, 17 percent; Pass a Loutre, 31.5 percent; and Southwest Pass, 31.5 percent.

* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

** US Army Engineer District, New Orleans. "Feasibility Report - Deep Draft Access to Ports of New Orleans and Baton Rouge, July 1974," New Orleans, La.

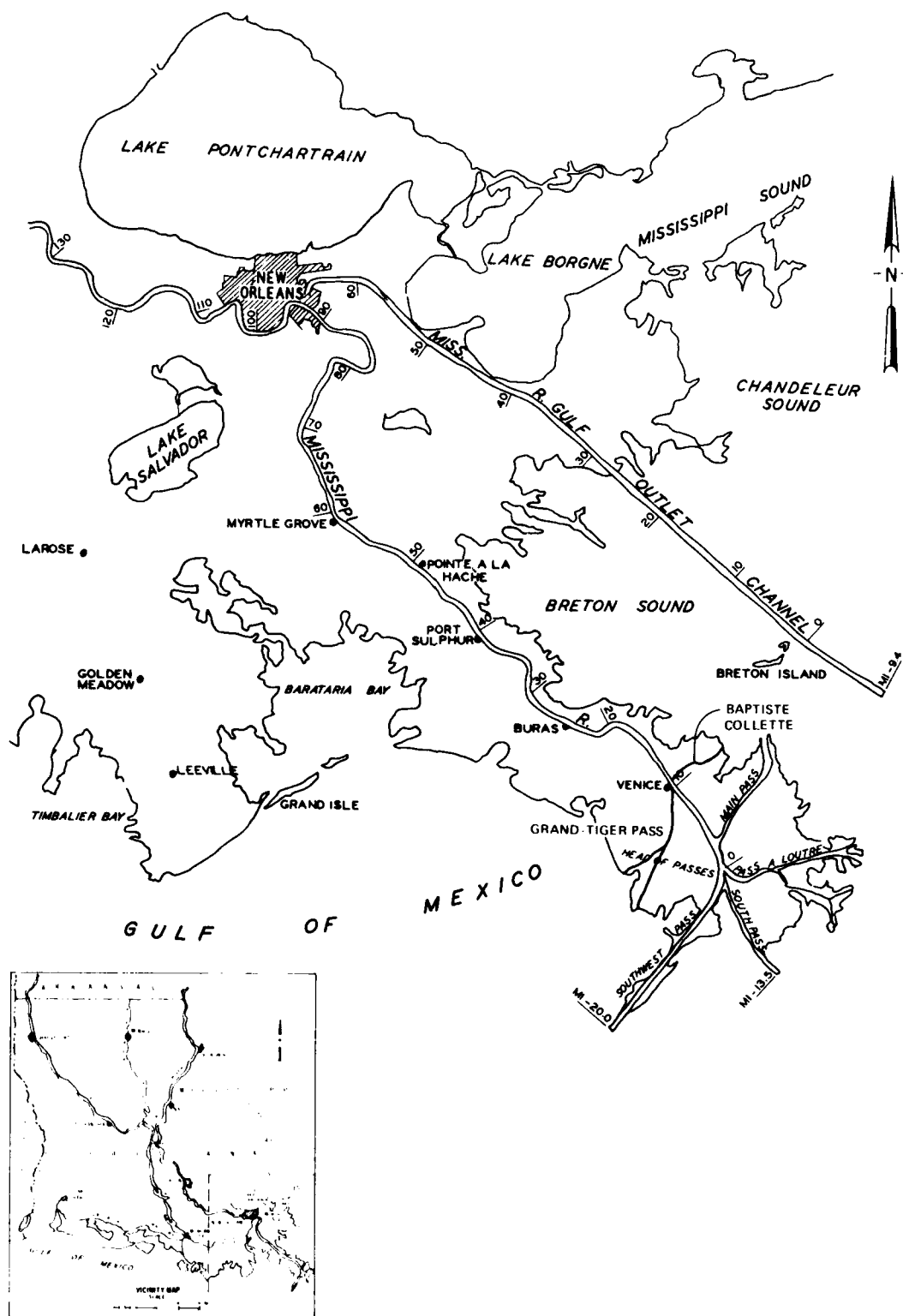


Figure 1. Location map

Hydraulic Characteristics

9. The mean tide range below the entrance to Southwest Pass is about 1.3 ft. At times of low river stages, tidal effects are evident 250 miles upstream from the river mouth. At times of high river stages, the tidal effect is minimized; and at extreme flood stages, the effect is almost imperceptible above HOP. Current velocities in the freshwater portion of Southwest Pass are extremely variable because of variations in river discharge, tidal action, and saltwater intrusion. During high river discharges, flow may be in the ebb direction at the surface at about 10 fps and simultaneously may be in the flood direction on the bottom at about 3 fps. Reversal in surface current direction due to tidal action is not encountered in Southwest Pass.

Salinity Characteristics

10. Salinity intrusion into Southwest Pass and into the Mississippi River itself is in the form of a wedge with a well-defined interface. At very low freshwater discharges, the wedge tip has reached about 150 miles upstream from the Gulf. During high river stages, the saltwater wedge is held at the ends of the jetties by the strong river current.

11. Southwest Pass is an excellent example of a highly stratified estuary. Upstream from the limits of saltwater intrusion, the direction of flow throughout the entire depth is downstream at all times with a vertical velocity distribution similar to that of an upland stream. Farther downstream the flow in the freshwater stratum is still toward the sea, but the direction of the flow in the underlying salt water is upstream at all times.

Shoaling Characteristics

12. During high freshwater discharges, the Mississippi River transports a vast sediment load. As the river spreads out and slows down, extensive shoaling occurs at HOP and at the tip of the jetties area. Several factors are involved in the shoaling characteristics, such as littoral currents, tidal action, wind and waves, freshwater discharge, flow separation at HOP, reduction in current velocities due to changes in the channel cross section, and location of the saltwater wedge as determined by the freshwater

discharge. The most important of these factors is the freshwater discharge, which controls the location of the saltwater wedge since rapid shoaling usually occurs near the tip of the saltwater intrusion in a highly stratified estuary such as Southwest Pass. As the freshwater discharge decreases, shoaling occurs farther upstream; the greater the discharge, the farther downstream shoaling occurs. Heavy shoaling usually occurs below mile 8.0 BHP in Southwest Pass. Bed-load material moves along the riverbed by the freshwater currents until it encounters the saltwater wedge or significant velocity reductions. The velocity is then not sufficient to carry any appreciable amount of the bed load out of the channel into the Gulf. Material in suspension gradually settles through the interface when the fresh water loses its velocity in the Gulf, and is transported upstream by the saltwater currents in the lower layers to the vicinity of the saltwater tip. The channel reach occupied by the upstream limits of the intrusion is therefore a focal point for accumulation of sediment from both upstream and downstream.

PART III: THE MODEL

13. The Mississippi River Passes model reproduces the Mississippi River from approximately 100 miles downstream from New Orleans, La., to the Gulf of Mexico. The upper limit of the model is at Venice, La. (mile 10 above HOP), and includes all of Southwest Pass and South Pass, portions of Main Pass and Pass a Loutre, and a portion of the Gulf of Mexico within the limits shown in Figure 2 and Plate 1. Channel depth was 44 ft.

14. The model was constructed of concrete to linear scale ratios, model to prototype, of 1:500 horizontally and 1:100 vertically. These scale ratios fixed the following model to prototype relations: slope 5:1, velocity 1:10, time 1:50, discharge 1:500,000, and volume 1:25,000,000. The salinity scale ratio was 1:1, and the model Gulf supply was maintained at a salinity of 34,000 parts per million (ppm). One prototype tidal cycle of 24.84 hr was reproduced in the model in 29.81 min. The model was approximately 327 ft long and 289 ft wide at the widest point, and covered an area of about 26,000 sq ft. The model was constructed in a shelter and was completely enclosed to protect it and its appurtenances from the weather and to permit uninterrupted operation. Descriptions of all the model appurtenances are presented in Report 1 of this series.

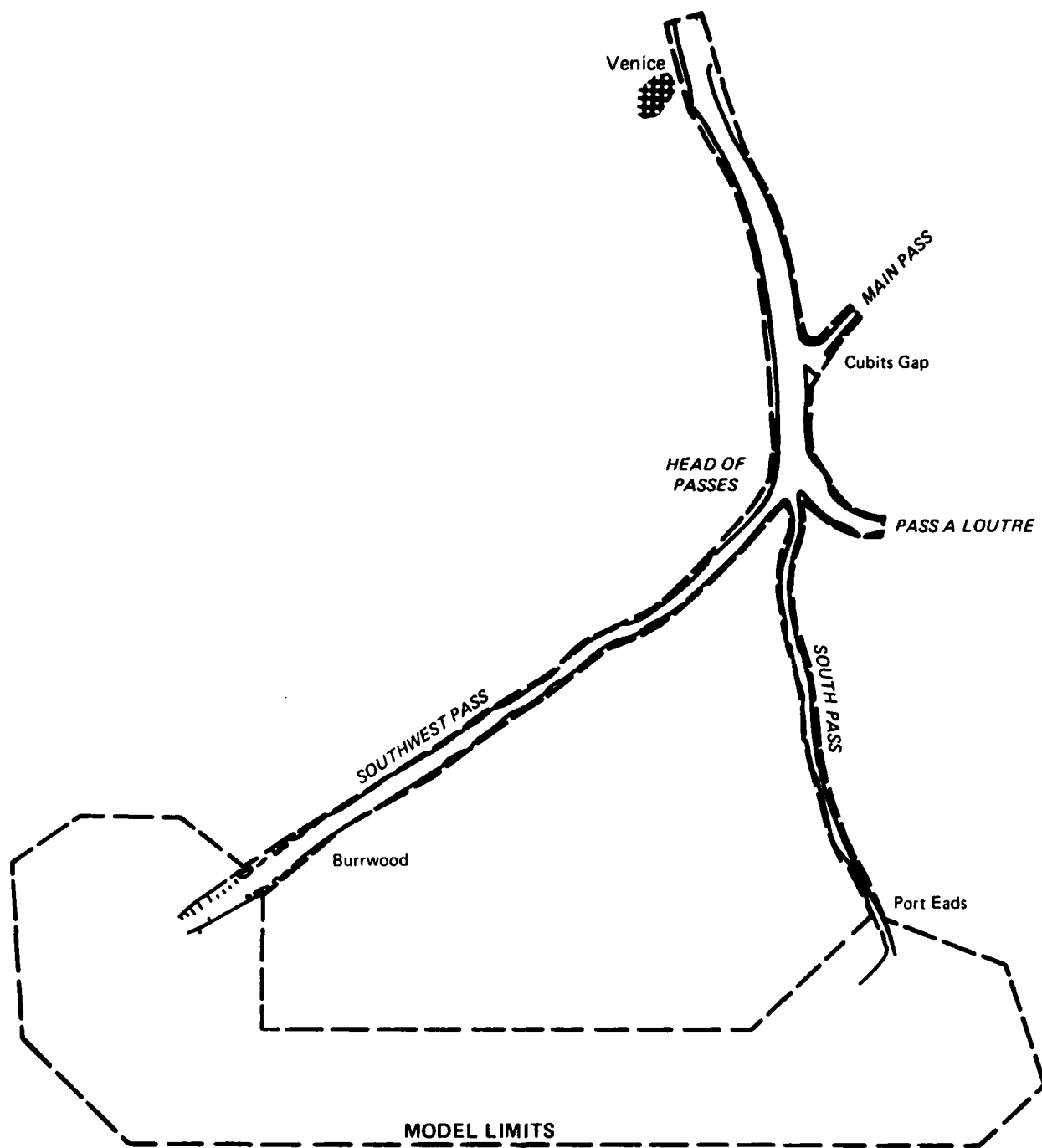


Figure 2. Mississippi River Passes channel model limits

PART IV: TESTING PROGRAM

Improvement Plans

15. The general types of tests proposed for reduction of shoaling between miles 10 and 15 and in the entrance channel of Southwest Pass, the improvement plans pertinent to each group of tests, and the general purpose of the model tests of each plan are given below:

<u>Type of Tests</u>	<u>Plan No.</u>	<u>Purpose of Tests</u>
Dike tests	1, 2, 3	To determine the effects of a constricted channel on shoaling
Sediment diversion channel tests 6, 6A 7, 7A, 7B	4, 4A, 4B 5, 5A, 5B	To divert sediment from main navigation channel
Sediment basin tests	8, 8A	To trap sediment normally deposited in the navigation channel at the entrance to Southwest Pass.
Sediment diversion channel plus sediment basin tests	9, 9A	To divert and trap sediment normally deposited in the navigation channel at the entrance to Southwest Pass
Simulated relocation of jetty channel upstream from ends of jetties	10	To determine effects of moving the bar channel upstream from the area of freshwater-saltwater mixing

Test Procedure

16. Model test conditions consisted of reproduction of freshwater discharges of approximately 640,000, 900,000, and 1,300,000 cfs, which correspond to Carrollton gage stages of 10, 14, and 18 ft, respectively, and a tide with a 1.1-ft range in the Gulf. After three stabilization cycles had been completed, 36,000 cc of shoaling material was equally distributed throughout the next six tidal cycles (Table 1) from mile 8.4 BHP or model section 50 (Plate 2) to the limit of salinity intrusion in lower Southwest Pass. The upstream limit of salinity intrusion in Southwest Pass for the 10-, 14-, and 18-ft Carrollton stages is approximately miles 18.0, 19.5, and 20.0 BHP, respectively. After all the shoaling material had been introduced, one more tidal cycle was reproduced before the test was concluded. At the conclusion of each shoaling test, the material that deposited in each channel section was

retrieved and measured. The same procedure for introducing shoaling material was followed in the tests for Plans 1-10. This method was used for all plans to study the effects of relative plans on the entire system and to have the same test conditions for comparison purposes.

Presentation of Data

17. Shoaling patterns for all tests reported herein are shown in appropriate plates. Test results of the dike tests (Plans 1-3) are summarized as shoaling indices in Table 2. Tables 3-11 list the individual shoaling quantities for each model channel section for each test in Plans 1-3. Table 12 shows the effects of Plans 1-3 on tide height at HOP. Tables 13-15 show the effects of Plans 1-3 on current velocities at five stations in Southwest Pass. Test results of the sediment diversion channel tests (Plans 4-7B) are summarized as shoaling indices in Table 16. Tables 17-24 list the individual shoaling quantities for the model channel sections in the problem area for Plans 4-7B. Test results of the sediment basin tests (Plans 8 and 8A), the sediment diversion channel plus sediment basin tests (Plans 9-9A), and the relocation of the jetty channel tests (Plan 10) are summarized as shoaling indices in Table 25. Tables 26-30 list the individual shoaling quantities for the model channel sections in the problem area for these plans. A "shoaling index" is computed by dividing the plan shoaling volume for a channel section by the base test shoaling volume for the same channel section. Therefore, if the plan reduces shoaling, the shoaling index is less than 1.0; and if the plan increases shoaling, the shoaling index is greater than 1.0. Evaluation of the effectiveness of any given plan is based on the shoaling indices listed in the tables for each plan.

Lateral Spur Dike Tests

18. Proposed improvement Plans 1-3 were tested to determine the effectiveness of reducing shoaling by adding lateral spur dikes in the problem area. Results of these tests were compared with results of similar tests of existing or base conditions (Plates 2, 3, and 4). Table 2 is a summary of the shoaling indices for Plans 1-3. The table is divided into three areas of shoaling plus the total channel and Gulf. Area 1 is upstream of the area of

the added dike field, and includes channel sections 50-55; area 2 is adjacent to the added dike field, and includes channel sections 56-76; and area 3 is the area downstream of the added dikes, and includes channel section 77-99. Tables 3-11 are tables of each plan's shoaling indices by channel sections. Tidal heights and current velocities were taken at the locations shown in Plate 1 for Plans 1-3 and are summarized in Tables 12-15.

Plan 1, opposite dike tests

19. Plan 1 consisted of extending the 24 existing short dikes on the west bank of Southwest Pass between miles 10.0 and 14.6 BHP and adding 26 dikes on the east bank opposite those on the west bank. The clearance fairway between the dikes was approximately 1,420 ft. Elements of the plan are presented in Plate 5 and the shoaling patterns obtained for the three stages on the Carrollton gage (10, 14, and 18 ft) are presented in Plates 6, 7, and 8. Test results (Table 2) indicated that Plan 1 caused shoaling to increase both above (area 1) and below (area 3) the field of added dikes for all three stages and an increase in the amount of material deposited in the Gulf for the 14- and 18-ft stages. In area 2, the area adjacent to the added dikes, the shoaling indices for the three stages were 0.91, 0.94, and 0.77, which indicates an overall reduction in shoaling in that area for all three stages. The reduction was only 9 and 6 percent for the 10- and 14-ft stages, respectively, but was a significant reduction of 23 percent for the 18-ft stage. The overall shoaling for Southwest Pass showed no change for the 10- and 14-ft stages, but a reduction of 3 percent for the 18-ft stage.

Plan 2, offset dike tests

20. Plan 2 consisted of extending the 24 short dikes on the west bank of Southwest Pass between miles 10 and 14.6 BHP as in Plan 1 and adding 27 dikes on the east bank in a staggered position with regard to the spaces between those on the west bank. This plan could determine whether dikes that are added on the east bank should be directly opposite dikes on the west bank as in Plan 1 or offset or staggered as in Plan 2. Elements of the plan are presented in Plate 9 and the shoaling patterns obtained for the three Carrollton gage river stages (10, 14, and 18 ft) are presented in Plates 10, 11, and 12. Test results (Table 2) indicated that Plan 2 caused an increase in shoaling in both areas above (area 1) and below (area 3) the area of the field of added dikes (area 2) for all three stages, and showed an increase in the amount of material deposited in the Gulf for the 14- and 18-ft stages. In

area 2, the area adjacent to the added dikes, the shoaling indices for the three stages were 0.94, 0.87, and 0.83, which indicates an overall reduction in shoaling in that area of 6, 13, and 17 percent for the 10-, 14-, and 18-ft stages, respectively. The overall shoaling for Southwest Pass was unchanged for all three stages.

Plan 3, additional opposite dike tests

21. Plan 3 consisted of the additions and extensions of all the dikes as in Plan 1 plus the addition of four dikes on the east bank between miles 14.8 and 15.7 BHP. Elements of the plan are presented in Plate 13 and the shoaling patterns obtained for the three Carrollton gage river stages (10, 14, and 18 ft) are presented in Plates 14, 15, and 16. Test results (Table 2) indicate that Plan 3, as was the case in Plans 1 and 2, caused an increase in shoaling in both areas above (area 1) and below (area 3) the area of the field of added dikes (area 2) for all three stages, and showed an increase in the amount of material deposited in the Gulf for the 14- and 18-ft stages. In area 2, the area adjacent to the added dikes, the shoaling indices for the three stages were 0.93, 0.89, and 0.82, which indicates an overall reduction in shoaling in that area of 7, 11, and 18 percent for the 10-, 14-, and 18-ft stages, respectively. The overall changes in shoaling in Southwest Pass showed no change for the 10-ft stage, a reduction of 2 percent for the 14-ft stage, and an increase of 2 percent for the 18-ft stage.

Discussion of results of lateral spur dike tests

22. Results of tests involving extension of existing dikes and adding additional dikes indicated only slight benefits. The largest benefit in the problem area (area 2) would be realized during the 18-ft Carrollton gage river stage which showed a reduction of 23, 17, and 18 percent for Plans 1, 2, and 3, respectively. A corresponding increase of 27, 25, and 33 percent in shoaling in the area (area 1) upstream of the problem area was indicated for the same test conditions, with a slight increase in shoaling of 15, 16, and 18 percent in the area (area 3) downstream of the problem area. As seen in Table 2, the overall shoaling in Southwest Pass remained relatively unchanged for Plans 1-3, but the distribution of the material in the channel is affected significantly by the location of the plan dikes.

Hydraulic Results, Plans 1-3

Tide heights at Head of Passes

23. Table 12 presents the effects of Plans 1, 2, and 3, on the tide heights at HOP. The table lists the high-water and low-water readings for the tidal cycle plus the overall tide range for the plans as compared with the base. For Plans 1, 2, and 3, there was a slight lowering of high-water and low-water readings of 0.2 or 0.3 ft at HOP for all three Carrollton stages. The tide range remained the same for the 10- and 14-ft stages and dropped 0.1 ft for the 18-ft stage.

Current velocities

24. Current velocities were measured at three depths (surface, mid-depth, and bottom) and averaged over the tidal cycle. The data were measured at five center-line stations as seen in Plate 1 for Plans 1-3. The stations were at river miles 5.7, 9.0, 11.9, 14.1, and 17.5 BHP. Velocity changes of more than 0.5 fps were considered significant.

Current velocities, Plan 1

25. Test results showing the effects of Plan 1 on current velocities in Southwest Pass are presented in Table 13 for the three Carrollton gage river stages (10, 14, and 18 ft). At station miles 5.7 and 9.0, above the plan dikes, there was a slight overall reduction in average velocities. At station mile 11.9, near the beginning of the plan dikes, there was a slight increase in the average velocities. At station mile 14.1, near the end of the plan dikes, there were significant increases (+0.5 to +1.0 fps) in the average velocities for all three Carrollton stages with the exception of the bottom for Carrollton gage 18. At station mile 17.5, below the plan dikes, there were significant reductions (-0.6 and -0.7 fps) in the average velocities for the 10- and 14-ft stages in four of the six locations with slight reduction for the 18-ft stage.

Current velocities, Plan 2

26. Test results showing the effects of Plan 2 on current velocities in Southwest Pass are presented in Table 14 for the three Carrollton gage river stages (10, 14, and 18 ft). Test results indicate a slight overall reduction in average velocities at station miles 5.7 and 9.0. At station mile 11.9, there was a slight increase in the surface velocities for all three stages while there was a slight decrease in the bottom velocities. At station

mile 14.1, there was an overall increase in the average velocities for all three Carrollton stages, ranging from +0.4 to +1.0 fps. Station mile 17.5 showed a reduction in average velocities from -0.5 to -0.7 fps with the exception of middepth and bottom velocities for the 18-ft stage which decreased -0.2 fps.

Current velocities, Plan 3

27. Test results showing the effects of Plan 3 on current velocities in Southwest Pass are presented in Table 15 for the three Carrollton gage river stages (10, 14, and 18 ft). Test results indicate very slight overall changes in average velocities at station miles 5.7, 9.0, and 11.9. There was an overall increase (+0.4 to +0.8 fps) at station mile 14.1 for all three stages. There was also an overall decrease (-0.4 to -0.7 fps) in average velocities at station mile 17.5 for all three stages.

Discussion of current velocity results

28. Test results for all three plans indicate no significant changes in average velocities at the two stations, miles 5.7 and 9.0, above the added dike fields. There were slight increases in the velocities at station mile 11.9, which was at the beginning of the plan dikes. The significant overall increases in velocities were at station mile 14.1, which was near the end of the plan dikes. Maximum velocity increases of 1.0 fps occurred in Plan 1 for the 14- and 18-ft stages, and in Plan 2 for the 18-ft stage. Significant overall decreases in velocities occurred for all three plans at station mile 17.5, below the plan dikes. The maximum decrease in velocity of 0.7 fps occurred in Plan 1 for the 14-ft stage, in Plan 2 for the 10-ft stage, and in Plan 3 for both the 14- and 18-ft stages.

Sediment Diversion Channel Tests

29. Proposed improvement Plans 4-7B were tested to determine their effectiveness in diverting sediment from the main navigation channel, thereby reducing shoaling in the channel. River stages of 14 and 18 ft as measured on the Carrollton gage were selected for the sediment diversion channel tests. Tests for river stages of 10 ft were not used due to no deposition in the lower channel area. The method of shoaling material injection was the same as for the lateral spur dike tests (Table 1). Table 16 is a summary of the results of Plans 4-7B, while Tables 17-24 are tables of each plan's shoaling indices.

30. Plates 17 and 18 are enlargements of the lower channel of Southwest Pass shown in Plates 3 and 4, showing the shoaling pattern results from the 14- and 18-ft Carrollton gage river stages base tests. These plates are repeated for convenience of comparison with Plans 4-7B. In both base tests, a large shoal completely crossed the channel between the tips of the jetties in section 97. A large shoal also formed in sections 93, 94, and 95.

31. Elements of Plans 4, 4A, and 4B are presented in Plate 19 and resulting shoaling patterns for the two Carrollton gage stages (14 and 18 ft) tested are shown in Plates 20-25. The plans consisted of adding an alternate sediment diversion channel 300 ft wide with depths of 25 ft (Plan 4), 32 ft (Plan 4A), and 44 ft (Plan 4B). Test results (Tables 16, 17, and 18) of Plan 4 indicated that shoaling in the lower Southwest Pass Channel (sections 92-99) was decreased by 11 percent (shoaling index of 0.89) for both the 14- and 18-ft stages. Plan 4A showed a decrease of 28 percent (shoaling index of 0.72) for the 14-ft stage and 24 percent for the 18-ft stage, while Plan 4B showed a decrease of 2 and 37 percent for the 14- and 18-ft stages, respectively. Although all three plans showed a reduction of shoaling in the main navigation channel and shoaling patterns in Plates 20-25 indicated that material moved down the diversion channel, a shoal still formed that crossed the navigation channel primarily in sections 97 and 98. Shoaling was reduced in all three plans for a stage of 14 ft in section 97. For the 18-ft stage, shoaling was increased 149 percent in section 98 for Plan 4, decreased 24 percent in section 97 for Plan 4A, and decreased 22 percent in section 97 for Plan 4B. Overall shoaling for Southwest Pass was reduced 4 and 3 percent for Plan 4, 4 and 8 percent for Plan 4A, and 3 and 17 percent for Plan 4B, for the 14- and 18-ft stages, respectively.

Plans 5, 5A, and 5B, 600-ft
sediment diversion channel tests

32. Elements of Plans 5, 5A, and 5B are presented in Plate 26 and resulting shoaling patterns for the two Carrollton gage stages (14 and 18 ft) tested are shown in Plates 27-32. The plans consisted of adding an alternate sediment diversion channel 600 ft wide with depths of 25 ft (Plan 5), 32 ft (Plan 5A), and 44 ft (Plan 5B). The only difference between these three plans and the preceding three plans is the increase in the sediment diversion channel width from 300 to 600 ft. Test results (Tables 16, 19, and 20) of Plan 5 indicated that for the 14-ft stage, the plan showed a decrease in

shoaling of 3 percent (shoaling index of 0.97) while for an 18-ft stage, the plan caused 72 percent (shoaling index of 0.28) less shoaling in the problem area (sections 92-99) than existing conditions. Plan 5A showed a decrease of 21 percent for the 14-ft stage and 35 percent for the 18-ft stage when compared with existing conditions. Plan 5B showed a decrease of 20 percent for the 14-ft stage and 62 percent (shoaling index of 0.38) for the 18-ft stage. Shoaling patterns shown in Plates 27-32 indicate that a shoal formed which crossed the navigation channel in section 97 in all tests except Plan 5 (Plate 28) for the 18-ft stage which is also the plan that caused the greatest reduction in shoaling in the problem area (sections 92-99). There was a reduction in shoaling in section 97 of 17, 36, and 36 percent for Plans 5, 5A, and 5B, respectively, for the 14-ft stage tests. For the 18-ft stage tests, shoaling was reduced 65, 68, and 9 percent in section 97 for Plans 5, 5A, and 5B, respectively. Overall shoaling in Southwest Pass was reduced 6, 4, and 3 percent for the 14-ft stage for Plans 5, 5A, and 5B, respectively. The reduction in overall shoaling for the 18-ft stage was 14, 11, and 14 percent for Plans 5, 5A, and 5B, respectively.

Plans 6 and 6A, 300-ft sediment
diversion channel with structures

33. Elements of Plans 6 and 6A are presented in Plate 33 and resulting shoaling patterns for the two Carrollton gage stages (14 and 18 ft) tested are shown in Plates 34-37. The plans consisted of adding structures on both sides of the sediment diversion channel tested in Plans 4 and 4A, and on the west side of the entrance channel of Southwest Pass. The sediment diversion channel was 300 ft wide with depths of 25 ft (Plan 6) and 32 ft (Plan 6A). Tests results (Tables 16, 21, and 22) of Plan 6 indicated that shoaling in the lower Southwest Pass Channel (sections 92-99) was increased 45 percent for the 18-ft stage, while Plan 6A showed a decrease of 21 percent for the 14-ft stage and an increase of 25 percent for the 18-ft stage. Shoaling patterns shown in Plates 34-37 indicate that a shoal formed which crossed the navigation channel in sections 97-99. There was a reduction in shoaling of 23 and 32 percent in section 97 for the 14-ft stage for Plans 6 and 6A and an increase of 53 and 284 percent in section 98 for the 18-ft stage for Plans 6 and 6A, respectively. There was a reduction in overall shoaling in Southwest Pass of 1 and 3 percent for the 14-ft stage, and an increase in shoaling of 10 and 9 percent for the 18-ft stage, for Plans 6 and 6A, respectively.

Plans 7, 7A, and 7B, 600-ft sediment
diversion channel with structures

34. Elements of Plans 7, 7A, and 7B are presented in Plate 38 and resulting shoaling patterns for the two Carrollton gage stages (14 and 18 ft) tested are shown in Plates 39-44. The plans consisted of adding structures on both sides of the sediment diversion channel tested in Plans 5, 5A, and 5B, and on the west side of the entrance channel of Southwest Pass. The sediment diversion channel was 600 ft wide with depths of 25 ft (Plan 7), 32 ft (Plan 7A), and 44 ft (Plan 7B). Test results (Tables 16, 23, and 24) of Plan 7 indicated that shoaling in the lower Southwest Pass Channel (sections 92-99) was increased 16 percent for the 14-ft stage test and 46 percent for the 18-ft stage test. Plan 7A test results indicated that shoaling was decreased 17 percent for the 14-ft stage test and 10 percent for the 18-ft stage test, while Plan 7B shoaling increased 3 percent for the 14-ft stage and decreased 90 percent for the 18-ft stage. Shoaling patterns shown in Plates 39-44 indicate that a shoal was formed over the complete width of the channel in all tests except in the Plan 7B test for the 18-ft stage where material was moved into the upper end of the diversion channel. For all three tests of Plans 7, 7A, and 7B for the 14-ft stage, shoaling in section 97 was decreased by 18, 39, and 37 percent while for the 18-ft stage, shoaling was increased 417 and 236 percent in section 98 with Plans 7 and 7A and decreased 85 percent in section 97 with Plan 7B. Overall shoaling in Southwest Pass for Plan 7 showed a reduction of 6 percent for the 14-ft stage and a slight increase of 4 percent for the 18-ft stage. Plans 7A and 7B showed a reduction in shoaling of 5 and 4 percent, respectively, for the 14-ft stage, and 2 and 21 percent for the 18-ft stage.

Discussion of results of the
sediment diversion channel tests

35. Results of tests of Plans 4-7B involving sediment channel and sediment channel with structures indicated some benefits for the Carrollton gage river stage of 14 ft. The maximum reduction in sections 92-99 was 28 percent for Plan 4A (14-ft stage), with a reduction of 24 percent in section 97 (18-ft stage). Plans 5, 5B, and 7B would effect a 72, 62, and 90 percent reduction in shoaling over the existing conditions in sections 92-99 for the 18-ft stage with a decrease of shoaling of 65, 9, and 85 percent in section 97. Plan 7B effected the greatest benefit with material being deposited in the diversion

channel instead of the main navigation channel (Plate 44). For the 14-ft stage, all of the tests of Plans 4-7B indicated a slight reduction in overall shoaling in Southwest Pass of 1 to 6 percent. For the 18-ft stage, there was a reduction in shoaling of 2 to 21 percent with the exception of Plans 6 and 6A, which showed an increase in channel shoaling of 9 to 10 percent.

Sediment Basin Tests

36. Proposed improvement Plans 8 and 8A (construction of a sediment basin) were tested to determine their effectiveness in trapping sediment that would normally deposit in the navigation channel at the entrance to Southwest Pass. River stages of 14 and 18 ft as measured on the Carrollton gage were selected for the sediment basin tests. The method of shoaling material injection was the same for Plans 8 and 8A as for Plans 1-7B (Table 1). Table 25 includes a summary of results of sediment basin tests, while Tables 26-30 are tables of each plan's shoaling indices.

Plans 8 and 8A, sediment basin tests

37. Elements of Plans 8 and 8A are presented in Plate 45 and resulting shoaling patterns for the two Carrollton gage stages (14 and 18 ft) tested are shown in Plates 46-48. The plans consisted of construction of a sediment basin 600 ft wide and 4,500 ft long on the west side of the entrance channel to Southwest Pass. The basin was tested at depths of 44 ft (Plan 8) and 60 ft (Plan 8A). Test results (Tables 25, 26, and 27) of Plan 8 indicated that shoaling in the lower Southwest Pass Channel (sections 92-99) decreased 4 percent for the 14-ft stage when compared with existing conditions. The 18-ft stage was not tested for Plan 8. Plan 8A test results indicated that shoaling was increased 24 percent for the 14-ft stage and 15 percent for the 18-ft stage. Shoaling patterns shown in Plates 46-48 indicate that a shoal was formed in section 97 which extended throughout the channel width. These tests indicated that the trap was not effective in trapping material, and did not reduce shoaling in the main navigation channel. Overall shoaling in Southwest Pass showed a 3 percent decrease for Plan 8 for the 14-ft stage. Plan 8A showed a 1 percent increase in overall shoaling for both the 14- and 18-ft stages.

Sediment Diversion Channel Plus Sediment Basin Tests

38. Proposed improvement Plans 9 and 9A made use of the combination of a sediment diversion channel and a sediment basin to divert and trap sediment normally deposited in the navigation channel at the entrance to Southwest Pass. River stages of 14 and 18 ft as measured on the Carrollton gage were selected for Plan 9 tests and only the 14-ft stage was selected for Plan 9A. The method of shoaling material injection was the same as that for Plans 1-8A (Table 1). Table 25 includes a summary of the results of Plans 9 and 9A while Tables 28 and 29 are tables of each plan's shoaling indices.

Plans 9 and 9A, sediment diversion channel plus sediment basin tests

39. Elements of Plans 9 and 9A are presented in Plate 49 and resulting shoaling patterns for the two Carrollton gage stages (14 and 18 ft) tested are shown in Plates 50-52. The plans consisted of construction of a sediment basin 600 ft wide and 4,500 ft long on the west side of the entrance channel to Southwest Pass with a sediment diversion channel 600 ft wide and 25 ft deep. The depths of the sediment basin were 44 ft (Plan 9) and 60 ft (Plan 9A). Plan 9 test results indicate that shoaling was decreased 13 percent for the 14-ft stage and increased 17 percent for the 18-ft stage. Plan 9A test results indicate that shoaling increased 7 percent for the 14-ft stage. In all three tests, a shoal was formed in sections 96 and 97 (Plates 50-52). Plan 9 showed a reduction in the overall shoaling in Southwest Pass of 1 and 2 percent for the 14- and 18-ft stages, respectively. There was no change in the overall shoaling for Plan 9A. As was the case in the sediment basin tests, the combination of a sediment basin and diversion channel was not effective in reducing shoaling in the main navigation channel.

Relocation of Jetty Channel Tests

40. Elements of Plan 10 are presented in Plate 53 and resulting shoaling patterns are shown in Plates 54 and 55. This plan was conducted in lieu of reconstructing the model area to repeat previous model tests of Plan 17A. Results of Plan 17A were reported in WES Technical Report No. 2-690.* These

* Simmons and Rhodes, op. cit., p. 4.

test results are still valid and should be used in evaluating plans to reduce shoaling in the lower channel of Southwest Pass. It should be noted that Plans 10 and 17A are two entirely different tests and the results should not be compared directly. Plan 17A involved constructing a new entrance channel to Southwest Pass through the East Jetty at approximately mile 19.1 and running parallel to the existing bar channel to the Gulf. The existing entrance channel and bar channel would be allowed to shoal to natural conditions. Plan 10 consisted of the construction of an extension of the jetties below the entrance channel to Southwest Pass. The jetties are approximately 2,000 ft wide and 4,000 ft long. The area between the jetties was filled to its normal shoaling depths. Table 25 is a summary of the results of Plan 10 tests, while Table 30 shows the plan's shoaling indices. Test results (Table 25) of Plan 10 indicated that shoaling in the lower Southwest Pass Channel (sections 92-99) increased 18 percent for the 14-ft stage and 30 percent for the 18-ft stage. Overall shoaling in Southwest Pass increased 4 and 11 percent for the 14- and 18-ft stages, respectively, for Plan 10.

PART V: CONCLUSIONS

41. Results of Plans 1-3 involving extension of existing dikes and adding additional dikes indicated a reduction of shoaling in the area of the dikes. These benefits of the plans would be offset by evidence of increased shoaling upstream and downstream of the problem area. Results of the hydraulic tests for Plans 1-3 indicate that the current velocities generally increased where the plan dikes were added which is compatible with the reduction in shoaling in the channel where dikes were added.

42. Results of tests of Plans 4-5B involving the sediment diversion channel indicate a slight reduction in overall shoaling of 3 to 6 percent for the 14-ft stage and a reduction in shoaling of 3 to 17 percent for the 18-ft stage. Some benefit is achieved because material is deposited in the diversion channel instead of the main navigation channel. However, the sediment diversion channel will also need maintenance dredging.

43. Results of tests of Plans 6-7B involving the sediment diversion channel with structures indicate a slight reduction in overall shoaling of 1 to 6 percent for the 14-ft stage tests. There was an increase in overall channel shoaling of 10, 9, and 4 percent for Plans 6, 6A, and 7, respectively, for the 18-ft stage tests. Plan 7A showed a 2 percent reduction and Plan 7B a 21 percent reduction in overall channel shoaling for the 18-ft stage tests. As with Plans 4-5B, some benefits are achieved because material is deposited in the diversion channel instead of the main navigation channel.

44. Results of tests of Plans 8 and 8A involving a sediment basin indicated that the trap was not effective in reducing shoaling in the main navigation channel. Results of the tests of Plans 9 and 9A involving the use of the combination of a sediment diversion channel and a sediment basin to divert and trap sediment normally deposited in the navigation channel at the entrance to Southwest Pass indicated that this was not an effective way of reducing shoaling in the main navigation channel.

45. Results of tests of Plan 10 indicate an increase in shoaling in the channel and that this plan was not effective in reducing channel shoaling.

46. The shoaling reductions mentioned above are not indicated for the same areas and may differ from plan to plan.

Table 1
Shoaling Material Injection Rate and Time of Injection
from Mile 8.4 to Tip of Salinity Intrusion

<u>Model</u> <u>Tidal Cycles</u>	<u>Hour</u>	<u>Amount of Material</u> <u>cc</u>	
1-3		0	Model stability
4	0	5,000	
	6	1,500	
	12		
	18		
5	0		
	6		
	12		
	18		
6	0		
	6		
	12		
	18		
7	0		
	6		
	12		
	18		
8	0		
	6	1,000	
	12		
	18		
9	0		
	6		
	12		
	18		
		<hr/> 36,000	Total material injected

Table 2
Lateral Spur Dike Tests
Summary of Shoaling Indices

<u>Plan</u>	<u>Area 1</u>	<u>Area 2</u>	<u>Area 3</u>	<u>Total Channel</u>	<u>Gulf</u>
	<u>Miles 8.4-9.8</u> <u>Sections 50-55</u>	<u>Miles 9.8-14.8</u> <u>Sections 56-76</u>	<u>Miles 14.8-20.4</u> <u>Sections 77-98</u>	<u>Miles 8.4-20.4</u> <u>Sections 50-98</u>	
<u>10 ft</u>					
1	1.08	0.91	1.09	1.00	--
2	1.06	0.94	1.06	1.00	--
3	1.10	0.93	1.06	1.00	--
<u>14 ft</u>					
1	1.04	0.94	1.05	1.00	1.49
2	1.08	0.87	1.10	1.00	1.87
3	1.21	0.89	1.04	0.98	1.93
<u>18 ft</u>					
1	1.27	0.77	1.15	0.97	1.33
2	1.25	0.83	1.16	1.00	1.13
3	1.33	0.82	1.18	1.02	1.04

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 3
Plan 1 Opposite Dike Tests
Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	10	10	1.00	77	1,075	1,200	1.11
51	275	490	1.78	78	980	860	0.87
52	965	1,105	1.14	79	890	855	0.96
53	630	610	0.96	80	680	670	0.98
54	875	745	0.85	81	855	660	0.77
55	830	915	1.10	82	265	315	1.18
Subtotal				83	1,340	1,255	0.93
50-55	3,585	3,875	1.08	84	1,310	1,405	1.07
56	925	685	0.74	85	525	620	1.18
57	370	615	1.66	86	1,310	1,615	1.23
58	790	465	0.58	87	920	1,030	1.11
59	1,105	920	0.83	88	135	285	2.11
60	350	500	1.42	89	1,555	1,875	1.20
61	1,060	555	0.52	90	975	1,705	1.74
62	550	715	1.30	91	1,140	1,160	1.01
63	485	850	1.75	92	105	125	1.19
64	965	905	0.93	93	210	30	0.14
65	675	525	0.77	94	40	140	3.50
66	960	535	0.55	95	195	205	1.05
67	160	470	2.93	96	250	140	0.56
68	435	905	2.08	97	--	--	--
69	890	750	0.84	98	--	--	--
70	1,170	820	0.70	99	--	--	--
71	705	970	1.37	Subtotal			
72	2,245	1,175	0.52	77-99	14,755	16,150	1.09
73	670	640	0.95	Total	35,855	35,900	1.00
74	140	715	5.10	Gulf	--	--	--
75	2,115	1,015	0.47				
76	750	1,145	1.52				
Subtotal							
56-76	17,515	15,875	0.91				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 4
Plan 1 Opposite Dike Tests
Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	1,020	1,190	1.17
51	5	--	--	78	495	660	1.33
52	800	770	0.96	79	825	685	0.83
53	380	415	1.09	80	445	460	1.03
54	830	965	1.16	81	475	485	1.02
55	895	880	0.98	82	45	--	--
Subtotal				83	1,090	980	0.89
50-55	2,910	3,030	1.04	84	1,210	1,480	1.22
56	790	810	1.02	85	240	110	0.45
57	415	360	0.86	86	1,320	1,690	1.28
58	265	555	2.09	87	425	455	1.07
59	1,345	830	0.62	88	35	35	1.00
60	210	740	3.52	89	1,195	1,255	1.05
61	1,225	35	0.02	90	335	185	0.55
62	410	765	1.86	91	1,145	1,545	1.34
63	310	730	2.35	92	735	420	0.57
64	1,435	755	0.52	93	355	830	2.33
65	300	955	3.18	94	2,005	1,760	0.87
66	830	345	0.41	95	45	345	7.66
67	50	450	9.00	96	--	--	--
68	--	--	--	97	2,440	2,045	0.83
69	340	450	1.32	98	--	--	--
70	1,870	2,080	1.10	99	--	--	--
71	90	265	2.94	Subtotal			
72	2,805	1,595	0.56	77-99	15,880	16,615	1.05
73	330	195	0.59	Total	34,435	34,325	1.00
74	--	315	--	Gulf	860	1,285	1.49
75	2,100	1,355	0.64				
76	525	1,095	2.08				
Subtotal							
56-76	15,645	14,680	0.94				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 5
Plan 1 Opposite Dike Tests
Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	660	3,670	5.56
51	--	--	--	78	785	545	0.69
52	140	55	0.39	79	265	510	1.92
53	125	415	3.32	80	270	90	0.33
54	140	460	3.29	81	95	--	--
55	1,160	1,050	0.90	82	--	--	--
Subtotal				83	90	20	0.22
50-55	1,565	1,980	1.27	84	2,790	3,895	1.39
56	1,235	825	0.66	85	65	20	0.30
57	180	--	--	86	140	5	0.03
58	--	325	--	87	1,610	1,880	1.16
59	1,525	1,550	1.01	88	--	10	--
60	315	1,515	4.80	89	--	--	--
61	295	--	--	90	220	145	0.65
62	560	--	--	91	980	--	--
63	--	--	--	92	720	375	0.52
64	260	610	2.35	93	505	625	1.23
65	1,300	1,585	1.22	94	1,010	1,035	1.02
66	910	--	--	95	925	950	1.02
67	435	--	--	96	--	270	--
68	--	--	--	97	2,965	2,620	0.88
69	--	90	--	98	1,150	800	0.69
70	165	80	0.48	99	--	--	--
71	160	5	0.03	Subtotal			
72	4,620	4,110	0.88	77-99	15,245	17,465	1.15
73	445	605	1.35	Total	32,070	31,225	0.97
74	--	--	--	Gulf	2,955	3,920	1.33
75	1,305	--	--				
76	1,550	480	0.30				
Subtotal							
56-76	15,260	11,780	0.77				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 6
Plan 2 Offset Dike Tests
Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	10	--	--	77	1,075	1,610	1.49
51	275	340	1.23	78	980	1,020	1.04
52	965	960	0.99	79	890	1,105	1.24
53	630	670	1.06	80	680	700	1.02
54	875	920	1.05	81	855	845	0.98
55	830	905	1.09	82	265	275	0.99
Subtotal				83	1,340	1,250	1.15
50-55	3,585	3,795	1.06	84	1,310	1,385	1.05
56	925	785	0.84	85	525	440	0.83
57	370	620	1.67	86	1,310	1,435	1.09
58	790	765	0.96	87	920	1,010	1.09
59	1,105	810	0.73	88	135	225	1.66
60	350	800	2.28	89	1,555	1,400	1.32
61	1,060	590	0.55	90	975	1,000	1.02
62	550	530	0.96	91	1,140	970	0.85
63	485	940	1.93	92	105	290	2.76
64	965	600	0.62	93	210	5	0.02
65	675	860	1.27	94	40	215	5.37
66	960	850	0.88	95	195	120	0.61
67	160	180	1.12	96	250	400	1.60
68	435	505	1.16	97	--	--	--
69	890	710	0.79	98	--	--	--
70	1,170	1,165	0.99	99	--	--	--
71	705	360	0.51	Subtotal			
72	2,245	1,700	0.75	77-99	14,755	15,700	1.06
73	670	525	0.78	Total	35,855	35,920	1.00
74	140	975	6.96	Gulf	--	--	--
75	2,115	1,040	0.49				
76	750	1,115	1.48				
Subtotal							
56-76	17,515	16,425	0.94				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 7
Plan 2 Offset Dike Tests
Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	1,020	1,990	1.95
51	5	--	--	78	495	615	1.24
52	800	910	1.13	79	825	880	1.06
53	380	560	1.47	80	445	200	0.44
54	830	660	0.79	81	475	850	1.78
55	895	1,005	1.12	82	45	5	0.11
Subtotal				83	1,090	435	0.39
50-55	2,910	3,135	1.08	84	1,210	2,005	1.67
56	790	1,025	1.29	85	240	345	1.43
57	415	385	0.92	86	1,320	1,105	0.83
58	265	385	1.45	87	425	690	1.62
59	1,345	735	0.54	88	35	125	3.57
60	210	1,060	5.04	89	1,195	1,480	1.23
61	1,225	65	0.05	90	335	310	0.92
62	410	895	2.18	91	1,145	1,075	0.93
63	310	305	0.98	92	735	1,015	1.38
64	1,435	695	0.48	93	355	510	1.43
65	300	1,230	4.10	94	2,005	1,140	0.56
66	830	495	0.59	95	45	755	16.77
67	50	320	6.40	96	--	--	--
68	--	50	--	97	2,440	2,110	0.86
69	340	140	0.41	98	--	--	--
70	1,870	1,650	0.88	99	--	--	--
71	90	385	4.27	Subtotal			
72	2,805	1,575	0.56	77-99	15,880	17,640	1.11
73	330	275	0.83	Total	34,435	34,355	1.00
74	--	--	--	Gulf	860	1,610	1.87
75	2,100	1,170	0.55				
76	525	740	1.40				
Subtotal							
56-76	15,645	13,580	0.87				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 8
Plan 2 Offset Dike Tests
Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	660	1,450	2.19
51	--	--	--	78	785	2,895	3.68
52	140	290	2.07	79	265	565	2.13
53	125	440	3.52	80	270	--	--
54	140	150	1.07	81	95	--	--
55	1,160	1,070	0.92	82	--	--	--
Subtotal				83	90	200	2.22
50-55	1,565	1,950	1.25	84	2,790	4,385	1.57
56	1,235	655	0.53	85	65	100	1.53
57	180	--	--	86	140	--	--
58	--	--	--	87	1,610	1,885	1.17
59	1,525	1,030	0.67	88	--	--	--
60	315	1,780	5.65	89	--	--	--
61	295	--	--	90	220	--	--
62	560	--	--	91	980	--	--
63	--	--	--	92	720	510	0.70
64	260	675	2.00	93	505	760	1.50
65	1,300	1,210	0.93	94	1,010	455	0.45
66	910	60	0.06	95	925	560	0.60
67	435	--	--	96	--	510	--
68	--	--	--	97	2,965	2,155	0.72
69	--	--	--	98	1,150	1,225	1.06
70	165	215	1.30	99	--	--	--
71	160	245	1.53	Subtotal			
72	4,620	4,025	0.87	77-99	15,245	17,655	1.16
73	445	--	--	Total	32,070	32,205	1.00
74	--	--	--	Gulf	2,955	3,355	1.14
75	1,305	--	--				
76	1,550	2,705	1.74				
Subtotal							
56-76	15,260	12,600	0.83				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 9
Plan 3 Opposite Dike (with Four Additional Dikes) Tests
Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	10	--	--	77	1,075	815	0.75
51	275	200	0.72	78	980	1,350	1.37
52	965	1,135	1.17	79	890	1,085	1.21
53	630	545	0.86	80	680	840	1.23
54	875	1,105	1.26	81	855	1,135	1.32
55	830	960	1.15	82	265	265	1.00
Subtotal				83	1,340	1,435	1.07
50-55	3,585	3,945	1.10	84	1,310	1,430	1.12
56	925	735	0.79	85	525	505	0.96
57	370	920	2.48	86	1,310	1,430	1.09
58	790	635	0.80	87	920	895	0.97
59	1,105	1,135	1.02	88	135	145	1.07
60	350	760	2.17	89	1,555	1,555	1.00
61	1,060	395	0.37	90	975	210	0.21
62	550	900	1.63	91	1,140	1,470	1.28
63	485	825	1.70	92	105	240	2.28
64	965	740	0.76	93	210	115	0.54
65	675	680	1.00	94	40	35	0.87
66	960	475	0.49	95	195	120	0.61
67	160	240	1.50	96	250	555	2.22
68	435	975	2.24	97	--	--	--
69	890	595	0.66	98	--	--	--
70	1,170	1,060	0.90	99	--	--	--
71	705	815	1.15	Subtotal			
72	2,245	1,375	0.61	77-99	14,755	15,670	1.06
73	670	655	0.97	Total	35,855	35,930	1.00
74	140	620	4.42	Gulf	--	--	--
75	2,115	1,105	0.52				
76	770	675	0.87				
Subtotal							
56-76	17,515	16,315	0.93				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 10
Plan 3 Opposite Dike (with Four Additional Dikes) Test
Carrollton Stage, 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	1,020	865	0.85
51	5	--	--	78	495	1,410	2.84
52	800	1,070	1.33	79	825	835	1.01
53	380	395	1.03	80	445	550	1.23
54	830	885	1.06	81	475	400	0.84
55	895	1,170	1.30	82	45	730	16.22
Subtotal				83	1,090	120	0.11
50-55	2,910	3,520	1.21	84	1,210	1,880	1.55
56	790	825	1.04	85	240	350	1.45
57	415	360	0.86	86	1,320	920	0.70
58	265	725	2.73	87	425	760	1.78
59	1,345	800	0.59	88	35	35	1.00
60	210	1,095	5.21	89	1,195	630	0.52
61	1,225	40	0.03	90	335	550	1.64
62	410	760	1.85	91	1,145	1,325	1.15
63	310	275	0.88	92	735	940	1.27
64	1,435	1,205	0.83	93	355	645	1.81
65	300	935	3.11	94	2,005	1,490	0.74
66	830	295	0.35	95	45	--	--
67	50	150	3.00	96	--	--	--
68	--	--	--	97	2,440	2,070	0.84
69	340	120	0.35	98	--	--	--
70	1,870	1,130	0.60	99	--	--	--
71	90	850	9.44	Subtotal			
72	2,805	2,470	0.88	77-99	15,880	16,505	1.04
73	330	--	--	Total	34,435	33,915	0.98
74	--	--	--	Gulf	860	1,655	1.92
75	2,100	1,200	0.57				
76	525	655	1.24				
Subtotal							
56-76	15,645	13,890	0.89				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 11

Plan 3 Opposite Dike (with Four Additional Dikes) Tests
Carrollton Stage 18 ft

<u>Model Section</u>	<u>Base cc</u>	<u>Plan cc</u>	<u>Shoaling Index</u>	<u>Model Section</u>	<u>Base cc</u>	<u>Plan cc</u>	<u>Shoaling Index</u>
50	--	--	--	77	660	770	1.16
51	--	--	--	78	785	1,480	1.89
52	140	195	0.71	79	265	2,820	10.64
53	125	505	4.04	80	270	265	0.98
54	140	240	1.71	81	95	--	--
55	1,160	1,140	0.98	82	--	140	--
Subtotal				83	90	365	4.06
50-55	1,565	2,080	1.33	84	2,790	2,800	1.00
56	1,235	655	0.53	85	65	550	8.46
57	180	20	0.11	86	140	500	7.69
58	--	160	--	87	1,610	1,850	1.14
59	1,525	2,035	1.33	88	--	--	--
60	315	1,605	5.09	89	--	20	--
61	295	--	--	90	220	160	0.72
62	560	--	--	91	980	--	--
63	--	350	--	92	720	500	0.69
64	260	510	1.96	93	505	230	0.45
65	1,300	2,175	1.67	94	1,010	845	1.83
66	910	30	0.03	95	925	1,210	1.30
67	435	--	--	96	--	--	--
68	--	75	--	97	2,965	1,565	0.52
69	--	--	--	98	1,150	1,940	0.65
70	165	75	0.45	99	--	25	--
71	160	10	0.06	Subtotal			
72	4,620	3,240	0.70	77-99	15,245	18,040	1.18
73	445	870	1.95	Total	32,070	32,675	1.02
74	--	10	--	Gulf	2,955	3,080	1.04
75	1,305	150	0.11				
76	1,550	585	0.37				
Subtotal							
56-76	15,260	12,555	0.82				

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 12
Effects of Plans 1-3 on Tide Heights at Head of Passes

	<u>Base</u>	<u>Plan 1</u>	<u>Diff</u>	<u>Plan 2</u>	<u>Diff</u>	<u>Plan 3</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>							
High water	3.2	3.0	-0.2	3.0	-0.2	3.0	-0.2
Low water	2.5	2.3	-0.2	2.3	-0.2	2.3	-0.2
Range	0.7	0.7	0.0	0.7	0.0	0.7	0.0
<u>Carrollton Stage 14 ft</u>							
High water	4.2	3.9	-0.3	3.9	-0.3	3.9	-0.3
Low water	3.6	3.3	-0.3	3.3	-0.3	3.3	-0.3
Range	0.6	0.6	0.0	0.6	0.0	0.6	0.0
<u>Carrollton Stage 18 ft</u>							
High water	5.3	5.0	-0.3	5.0	-0.3	5.0	-0.3
Low water	5.0	4.8	-0.2	4.8	-0.2	4.8	-0.2
Range	0.3	0.2	-0.1	0.2	-0.1	0.2	-0.1

Table 13
Effects of Plans on Velocities* in Southwest Pass
Plan 1 Opposite Dike Tests

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
5.7	3.7	3.6	-0.1	3.3	3.3	0.0	2.4	2.4	0.0
9.0	3.4	3.2	-0.2	2.9	2.8	-0.1	2.3	2.0	-0.3
11.9	3.1	3.5	+0.4	2.8	2.8	0.0	2.0	2.1	+0.1
14.1	3.3	4.0	+0.7	2.7	3.4	+0.7	2.1	2.7	+0.6
17.5	3.6	3.0	-0.6	3.0	2.4	-0.6	2.3	1.9	-0.4
<u>Carrollton Stage 14 ft</u>									
5.7	5.1	5.0	-0.1	4.5	4.8	+0.3	3.5	3.5	0.0
9.0	4.5	4.8	+0.3	4.0	4.1	+0.1	3.0	3.1	+0.1
11.9	4.7	4.8	+0.1	4.4	4.5	+0.1	3.3	3.1	-0.2
14.1	4.8	5.4	+0.6	4.0	5.0	+1.0	3.2	3.7	+0.5
17.5	5.0	4.3	-0.7	4.4	4.0	-0.4	3.4	2.7	-0.7
<u>Carrollton Stage 18 ft</u>									
5.7	6.3	6.5	+0.2	5.8	6.0	+0.2	4.5	4.5	0.0
9.0	6.5	6.4	-0.1	5.9	5.6	-0.3	4.3	4.3	0.0
11.9	6.3	6.4	+0.1	5.6	6.1	+0.5	4.7	4.6	-0.1
14.1	6.5	7.5	+1.0	5.9	6.8	+0.9	4.5	4.7	+0.2
17.5	6.7	6.4	-0.3	5.8	5.8	0.0	4.6	4.2	-0.4

* Velocities are in feet per second and are an average over the tidal cycle.

Table 14
Effects of Plans on Velocities* in Southwest Pass
Plan 2 Offset Dike Tests

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
5.7	3.7	3.5	-0.2	3.3	3.2	-0.1	2.4	2.0	-0.4
9.0	3.4	3.3	-0.1	2.9	3.0	+0.1	2.3	2.0	-0.3
11.9	3.1	3.4	+0.3	2.8	2.8	0.0	2.0	1.7	-0.3
14.1	3.3	4.1	+0.8	2.7	3.2	+0.5	2.1	2.6	+0.5
17.5	3.6	2.9	-0.7	3.0	2.5	-0.5	2.3	1.8	-0.5
<u>Carrollton Stage 14 ft</u>									
5.7	5.1	4.9	-0.2	4.5	4.6	+0.1	3.5	3.3	-0.2
9.0	4.5	4.5	0.0	4.0	4.1	+0.1	3.0	3.2	+0.2
11.9	4.7	4.8	+0.1	4.4	4.3	-0.1	3.3	3.2	-0.1
14.1	4.8	5.6	+0.8	4.0	4.9	+0.9	3.2	3.7	+0.5
17.5	5.0	4.4	-0.6	4.4	3.8	-0.6	3.4	2.8	-0.6
<u>Carrollton Stage 18 ft</u>									
5.7	6.3	6.2	-0.1	5.8	5.7	-0.1	4.5	4.5	0.0
9.0	6.5	6.4	-0.1	5.9	5.6	-0.3	4.3	4.3	0.0
11.9	6.3	6.5	+0.2	5.6	6.1	+0.5	4.7	4.3	-0.4
14.1	6.5	7.5	+1.0	5.9	6.5	+0.6	4.5	4.9	+0.4
17.5	6.7	6.2	-0.5	5.8	5.6	-0.2	4.6	4.4	-0.2

* Velocities are in feet per second and are an average over the tidal cycle.

Table 15
Effects of Plans on Velocities* in Southwest Pass
Plan 3 Additional Opposite Dike Tests

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
5.7	3.7	3.7	0.0	3.3	3.4	+0.1	2.4	2.7	+0.3
9.0	3.4	3.2	-0.2	2.9	2.9	0.0	2.3	2.0	-0.3
11.9	3.1	3.4	+0.3	2.8	2.9	+0.1	2.0	2.4	+0.4
14.1	3.3	4.0	+0.7	2.7	3.4	+0.7	2.1	2.7	+0.6
17.5	3.6	3.0	-0.6	3.0	2.6	-0.6	2.3	1.9	-0.4
<u>Carrollton Stage 14 ft</u>									
5.7	5.1	5.1	0.0	4.5	4.8	+0.3	3.5	3.7	+0.2
9.0	4.5	4.7	+0.2	4.0	4.0	0.0	3.0	3.1	+0.1
11.9	4.7	4.9	+0.2	4.4	4.3	-0.1	3.3	3.2	-0.1
14.1	4.8	5.4	+0.6	4.0	4.8	+0.8	3.2	3.7	+0.5
17.5	5.0	4.3	-0.7	4.4	3.8	-0.6	3.4	2.7	-0.7
<u>Carrollton Stage 18 ft</u>									
5.7	6.3	5.9	-0.4	5.8	5.8	0.0	4.5	4.8	+0.3
9.0	6.5	6.4	-0.1	5.9	5.5	-0.4	4.3	4.2	-0.1
11.9	6.3	6.4	+0.1	5.6	5.6	0.0	4.7	4.3	-0.4
14.1	6.5	7.2	+0.7	5.9	6.4	+0.5	4.5	4.9	+0.4
17.5	6.7	6.0	-0.7	5.8	5.4	-0.4	4.6	4.0	-0.6

* Velocities are in feet per second and are an average over the tidal cycle.

Table 16
Sediment Diversion Channel Tests
Shoaling Indices Summary Table

Plan	Diversion Channel ft	Model Channel Sections					
		14-ft Stage			18-ft Stage		
		Shoaling Index			Shoaling Index		
		50-91	92-99	50-99	50-91	92-99	50-99
4	25 x 300	0.98	0.89	0.96	1.00	0.89	0.97
4A	32 x 300	1.01	0.72	0.96	0.97	0.76	0.92
4B	44 x 300	0.97	0.98	0.97	0.88	0.63	0.83
5	25 x 600	0.94	0.97	0.94	1.03	0.28	0.86
5A	32 x 600	0.99	0.79	0.96	0.96	0.65	0.89
5B	44 x 600	1.01	0.80	0.97	1.00	0.38	0.86
6	25 x 300	0.99	0.97	0.99	1.00	1.45	1.10
6A	32 x 300	1.01	0.79	0.97	1.04	1.25	1.09
7	25 x 600	0.90	1.16	0.94	0.92	1.46	1.04
7A	32 x 600	0.98	0.83	0.95	1.00	0.90	0.98
7B	44 x 600	0.94	1.03	0.96	1.00	0.10	0.79

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 17
Shoaling Indices, 300-ft Sediment Diversion Channel
Carrollton Stage 14 ft

Model Channel Sections	Base cc	Plan 4		Plan 4A		Plan 4B	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index	44 ft cc	Shoaling Index
50-91	28,855	28,245	0.98	29,070	1.01	28,050	0.97
92	735	640	0.87	180	0.24	255	0.31
93	355	660	1.86	480	1.35	1,010	2.85
94	2,005	1,880	0.94	1,990	0.99	1,690	0.84
95	45	230	5.11	10	0.22	520	11.56
96	--	--	--	--	--	--	--
97	2,440	1,545	0.63	1,340	0.55	2,020	0.83
98	--	5	--	--	--	--	--
99	--	--	--	--	--	--	--
Total of sections 92-99	5,580	4,960	0.89	4,000	0.72	5,465	0.98
Total of sections 50-99	34,435	33,205	0.96	33,070	0.96	33,515	0.97
S1		460		740		1,430	
S2		130		1,375		--	
S3		55		--		--	
S4		100		--		--	
S5		455		--		--	
S6		700		--		--	
S7		--		--		--	
Total of sections S1-S7		1,900		2,115		1,430	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 18
Shoaling Indices, 300-ft Sediment Diversion Channel
Carrollton Stage 18 ft

Model Channel Sections	Base cc	Plan 4		Plan 4A		Plan 4B	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index	44 ft cc	Shoaling Index
50-91	24,795	24,725	1.00	23,950	0.97	21,925	0.88
92	720	--	--	1,700	2.36	--	--
93	505	--	--	960	1.90	--	--
94	1,010	790	0.78	--	--	310	0.31
95	925	25	0.03	20	0.02	1,230	1.33
96	--	1,400	--	130	--	110	--
97	2,965	1,370	0.46	2,245	0.76	2,320	0.78
98	1,150	2,860	2.49	510	0.44	600	0.52
99	--	10	--	--	--	--	--
Total of sections 92-99	7,275	6,455	0.89	5,565	0.76	4,570	0.63
Total of sections 50-99	32,070	31,180	0.97	29,515	0.92	26,495	0.83
S1		10		--		1,690	
S2		10		--		6,240	
S3		--		--		1,000	
S4		190		30		20	
S5		340		4,000		--	
S6		2,005		1,600		--	
S7		--		--		--	
Total of sections S1-S7		2,555		5,630		8,950	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 19
Shoaling Indices, 600-ft Sediment Diversion Channel
Carrollton Stage 14 ft

Model Channel Sections	Base cc	Plan 5		Plan 5A		Plan 5B	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index	44 ft cc	Shoaling Index
50-91	28,855	27,100	0.94	28,690	0.99	29,115	1.01
92	735	190	0.26	270	0.37	230	0.31
93	355	700	1.97	630	1.77	1,060	2.99
94	2,005	2,010	1.00	1,760	0.88	1,600	0.88
95	45	500	11.11	185	4.11	--	--
96	--	--	--	--	--	--	--
97	2,440	2,025	0.83	1,550	0.64	1,560	0.64
98	--	--	--	--	--	--	--
99	--	--	--	--	--	--	--
Total of sections 92-99	5,580	5,435	0.97	4,395	0.79	4,450	0.80
Total of sections 50-99	34,435	32,535	0.94	33,085	0.96	33,565	0.97
S1		490		650		1,640	
S2		430		1,020		--	
S3		130				--	
S4		10		10		--	
S5		340		10		--	
S6		20		--		--	
S7		--		--		--	
Total of sections S1-S7		1,420		1,690		1,640	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 20
Shoaling Indices, 600-ft Sediment Diversion Channel
Carrollton Stage 18 ft

Model Channel Sections	Base cc	Plan 5		Plan 5A		Plan 5B	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index	44 ft cc	Shoaling Index
50-91	24,795	25,650	1.03	23,850	0.96	24,695	1.00
92	720	200	0.28	130	0.18	--	--
93	505	--	--	1,030	2.04	--	--
94	1,010	100	0.10	445	0.44	--	--
95	925	710	0.77	1,700	1.84	--	--
96	--	--	--	20	--	85	--
97	2,965	1,030	0.35	950	0.32	2,705	0.91
98	1,150	--	--	475	0.41	--	--
99	--	--	--	--	--	--	--
Total of sections 92-99	7,275	2,040	0.28	4,750	0.65	2,790	0.38
Total of sections 50-99	32,070	27,690	0.86	28,600	0.89	27,485	0.86
S1		--		30		580	
S2		--		90		7,670	
S3		--		510		--	
S4		100		15		--	
S5		230		105		--	
S6		1,740		6,215		--	
S7		300		--		--	
Total of sections S1-S7		2,370		6,965		8,250	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 21
Shoaling Indices, 300-ft Sediment Channel
with Structure, Carrollton Stage 14 ft

Model Channel Sections	Base cc	Plan 6		Plan 6A	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index
50-91	28,855	28,610	0.99	29,000	1.01
92	735	1,040	1.41	130	0.18
93	355	100	0.45	300	0.85
94	2,005	1,745	0.87	1,840	0.92
95	45	15	0.33	30	0.67
96	--	--	--	--	--
97	2,440	1,880	0.77	1,660	0.68
98	--	570	--	440	--
99	--	--	--	--	--
Total of sections 92-99	5,580	5,410	0.97	4,400	0.79
Total of sections 50-99	34,435	34,020	0.99	33,400	0.97
S1		--		20	
S2		--		--	
S3		--		--	
S4		--		1,370	
S5		355		30	
S6		1,260		--	
S7		--		--	
Total of sections S1-S7		1,615		1,420	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 22
Shoaling Indices, 300-ft Sediment Channel
with Structure, Carrollton Stage 18 ft

Model Channel Sections	Base cc	Plan 6		Plan 6A	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index
50-91	24,795	24,890	1.00	25,730	1.04
92	720	1,200	1.67	1,430	1.99
93	505	340	0.67	1,100	2.19
94	1,010	1,200	1.19	20	0.02
95	925	2,015	2.18	--	--
96	--	--	--	--	--
97	2,965	--	--	525	0.18
98	1,150	1,760	1.53	4,415	3.84
99	--	4,025	--	1,600	--
Total of sections 92-99	7,275	10,540	1.45	9,090	1.25
Total of sections 50-99	32,070	35,430	1.10	34,820	1.09
S1		--		135	
S2		--		135	
S3		--		175	
S4		--		--	
S5		20		430	
S6		380		20	
S7		--		--	
Total of sections S1-S7		400		985	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 23
Shoaling Indices, 600-ft Sediment Channel
with Structure, Carrollton Stage 14 ft

Model Channel Sections	Base cc	Plan 7		Plan 7A		Plan 7B	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index	44 ft cc	Shoaling Index
50-91	28,855	26,030	0.90	28,195	0.98	27,175	0.94
92	735	735	1.00	310	0.42	1,140	1.55
93	355	345	0.97	660	1.86	550	1.55
94	2,005	2,330	1.16	1,615	0.81	1,380	0.69
95	45	560	12.44	330	7.33	1,150	25.56
96	--	--	--	--	--	--	--
97	2,440	2,005	0.82	1,500	0.61	1,530	0.63
98	--	485	--	200	--	--	--
99	--	--	--	--	--	--	--
Total of sections 92-99	5,580	6,460	1.16	4,615	0.83	5,750	1.03
Total of sections 50-99	34,435	32,480	0.94	32,810	0.95	32,925	0.96
S1		330		210		1,270	
S2		60		1,300		1,780	
S3		10		250		--	
S4		5		525		--	
S5		700		--		--	
S6		70		--		--	
S7		--		--		--	
Total of sections S1-S7		1,175		2,285		3,050	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 24
Shoaling Indices, 600-ft Sediment Channel
with Structure, Carrollton Stage 18 ft

Model Channel Sections	Base cc	Plan 7		Plan 7A		Plan 7B	
		25 ft cc	Shoaling Index	32 ft cc	Shoaling Index	44 ft cc	Shoaling Index
50-91	24,795	22,810	0.92	24,740	1.00	24,760	1.00
92	720	140	0.19	--	--	--	--
93	505	1,720	3.41	--	--	--	--
94	1,010	1,160	1.15	630	0.62	270	0.27
95	925	--	--	1,120	1.21	--	--
96	--	--	--	--	--	--	--
97	2,965	470	0.16	935	0.32	435	0.15
98	1,150	5,950	5.17	3,865	3.36	--	--
99	--	1,180	--	--	--	--	--
Total of sections 92-99	7,275	10,620	1.46	6,550	0.90	705	0.10
Total of sections 50-99	32,070	33,430	1.04	31,290	0.98	25,465	0.79
S1		290		--		960	
S2		30		--		6,960	
S3		--		--		1,700	
S4		--		--		705	
S5		--		--		--	
S6		--		2,210		--	
S7		--		1,725		--	
Total of sections S1-S7		320		3,935		10,325	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 25

Summary of Shoaling Indices, Sediment Basin Tests (Plan 8, 8A),
Sediment Diversion Channel with Sediment Basin (Plan 9, 9A),
Relocation of Jetty Channel (Plan 10)

Plan	Sediment Basin Depth ft	Model Channel Sections					
		14-ft Stage			18-ft Stage		
		Shoaling Index			Shoaling Index		
		<u>50-91</u>	<u>92-99</u>	<u>50-99</u>	<u>50-91</u>	<u>92-99</u>	<u>50-99</u>
8	44	0.98	0.96	0.97			
8A	60	0.97	1.24	1.01	0.97	1.15	1.01
9	44	1.01	0.87	0.99	0.92	1.17	0.98
9A	60	0.99	1.07	1.00			
10	NA	1.02	1.18	1.04	1.06	1.30	1.11

Note: NA = not applicable.

Table 26
Shoaling Indices, Sediment Basin Tests
Carrollton Stage 14 ft

Model Channel Sections	Base cc	Plan 8		Plan 8A	
		44 ft cc	Shoaling Index	60 ft cc	Shoaling Index
50-91	28,855	28,135	0.98	27,865	0.97
92	735	--	--	700	0.95
93	355	1,280	3.61	875	2.46
94	2,005	1,130	0.56	2,180	1.09
95	45	1,205	26.78	175	3.89
96	--	735	--	2,130	--
97	2,440	1,020	0.42	850	0.35
98	--	--	--	--	--
99	--	--	--	--	--
Total of sections 92-99	5,580	5,370	0.96	6,910	1.24
Total of sections 50-99	34,435	33,505	0.97	34,775	1.01
96A		180		675	
97A		2,190		85	
97B		--		--	
98A		--		--	
Total of sections 96A-98A		2,370		760	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 27
Shoaling Indices, Sediment Basin Tests
Carrollton Stage 18 ft

Model Channel Sections	Base cc	Plan 8A	
		60 ft cc	Shoaling Index
50-91	24,795	23,990	0.97
92	720	--	--
93	505	--	--
94	1,010	1,930	1.91
95	925	--	--
96	--	1,300	--
97	2,965	4,570	1.68
98	1,150	560	0.49
99	--	--	--
Total of sections 92-99	7,275	8,360	1.15
Total of sections 50-99	32,070	32,350	1.01
96A		3,115	
97A		--	
97B		--	
98A		--	
Total of sections 96A-98A		3,115	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 28
Shoaling Indices, Sediment Basin and Diversion Channel
Carrollton Stage 14 ft

Model Channel Sections	Base cc	Plan 9		Plan 9A	
		44 ft cc	Shoaling Index	60 ft cc	Shoaling Index
50-91	28,855	29,255	1.01	28,575	0.99
92	735	20	0.03	300	0.41
93	355	520	1.46	570	1.61
94	2,005	1,460	0.73	2,190	1.09
95	45	700	15.56	20	0.44
96	--	1,170	--	1,840	--
97	2,440	980	0.40	1,030	0.42
98	--	--	--	--	--
99	--	--	--	--	--
Total of sections 92-99	5,580	4,850	0.87	5,950	1.07
Total of sections 50-99	34,435	34,105	0.99	34,525	1.00
96A		30		965	
97A		1,610		10	
97B		--		--	
98A		--		--	
Total of sections 96A-98A		1,640		975	

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table 29
Shoaling Indices, Sediment Basin and Diversion Channel
Carrollton Stage 18 ft

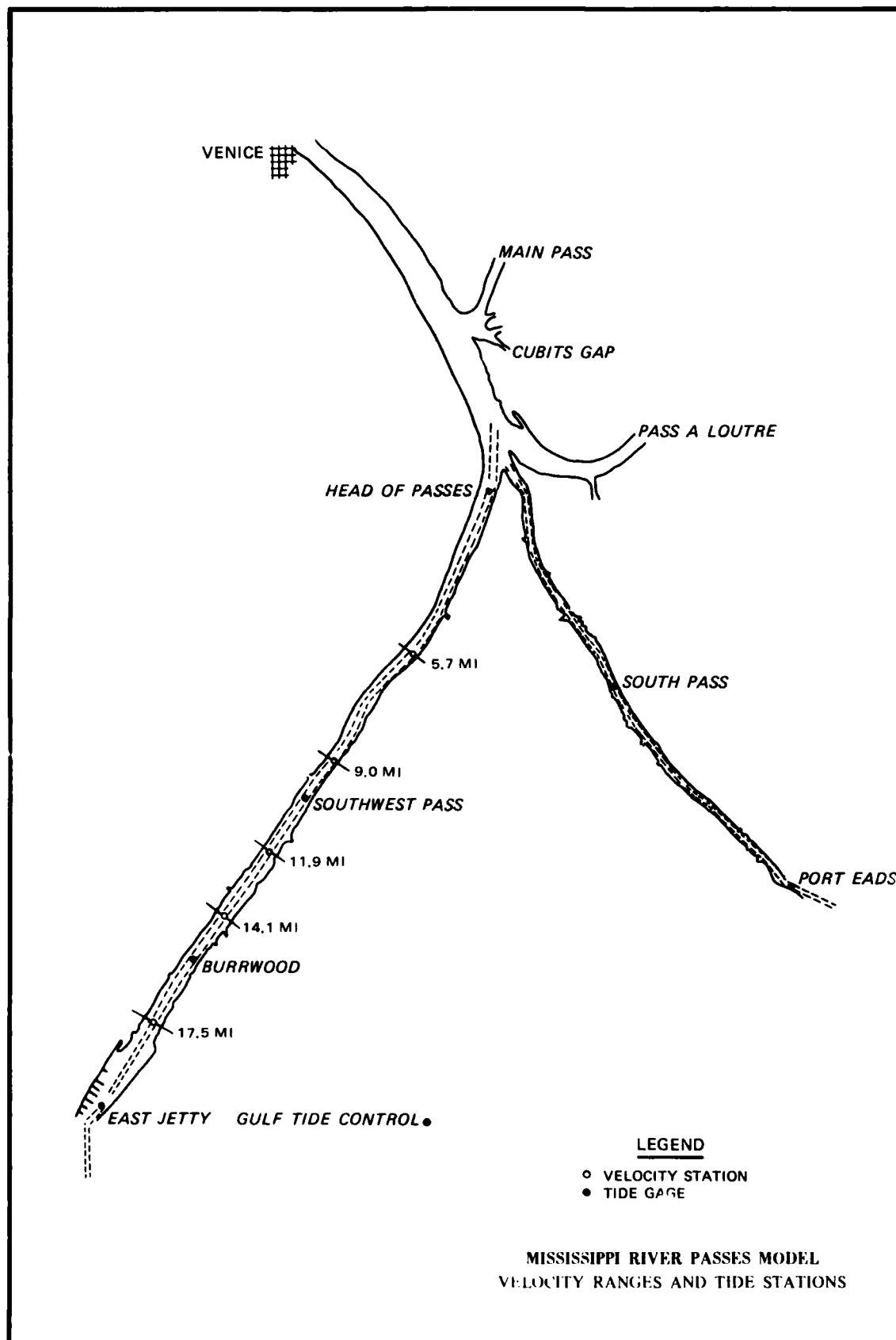
<u>Model Channel Sections</u>	<u>Base cc</u>	<u>Plan 9</u>	
		<u>44 ft cc</u>	<u>Shoaling Index</u>
50-91	24,795	22,890	0.92
92	720	--	--
93	505	840	1.66
94	1,010	1,000	0.99
95	925	--	--
96	--	360	--
97	2,965	4,050	1.37
98	1,150	2,250	1.96
99	--	--	--
Total of sections 92-99	7,275	8,500	1.17
Total of sections 50-99	32,070	31,390	0.98
96A		200	
97A		1,640	
97B		2,700	
98A		--	
Total of sections 96A-98A		4,540	

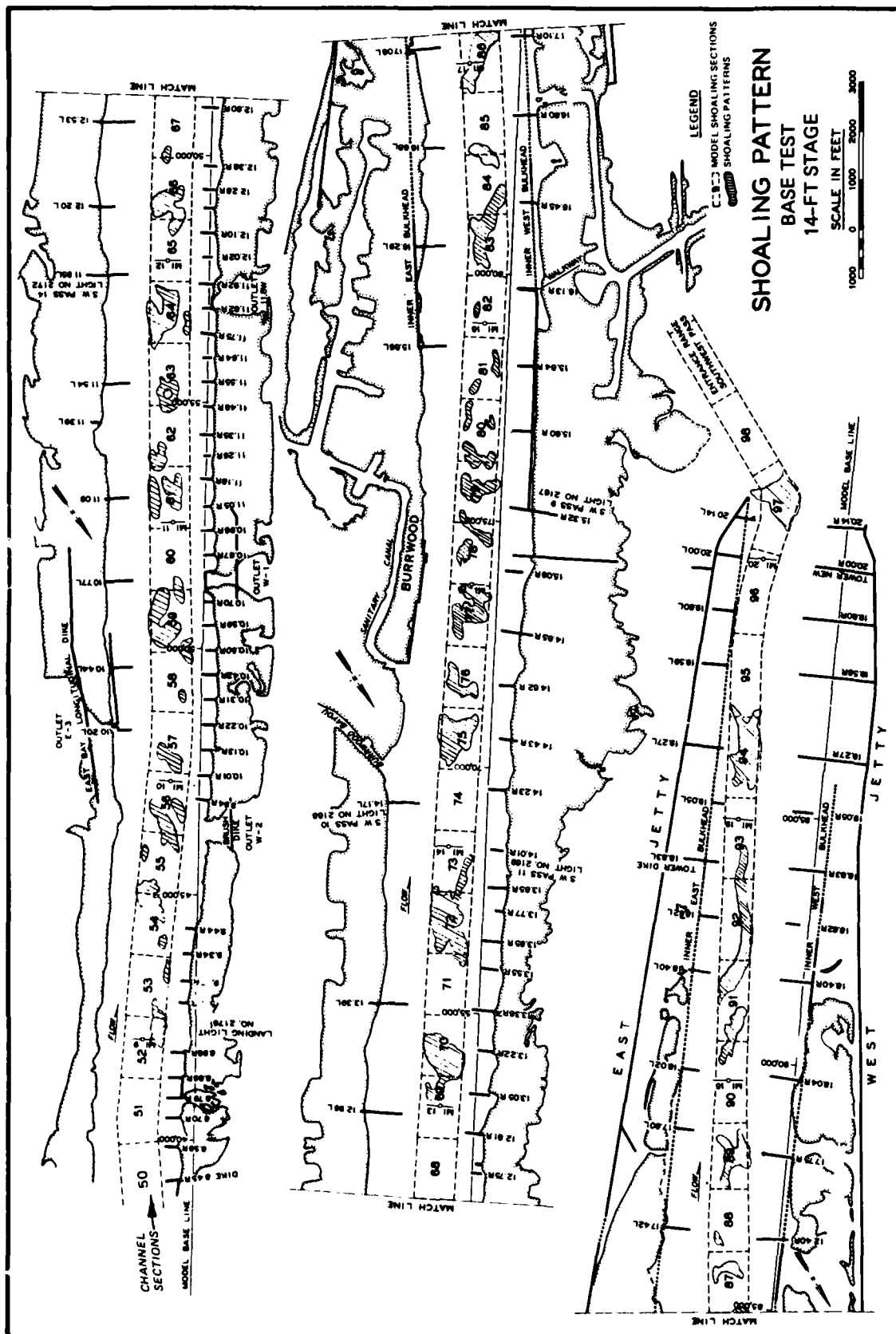
Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

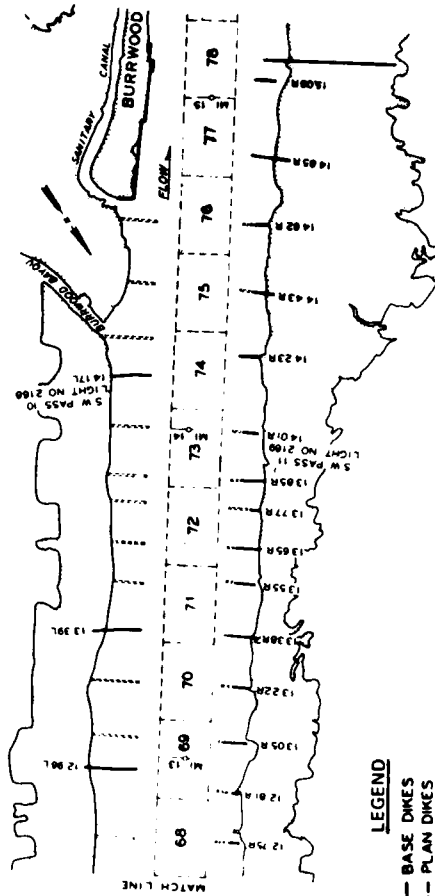
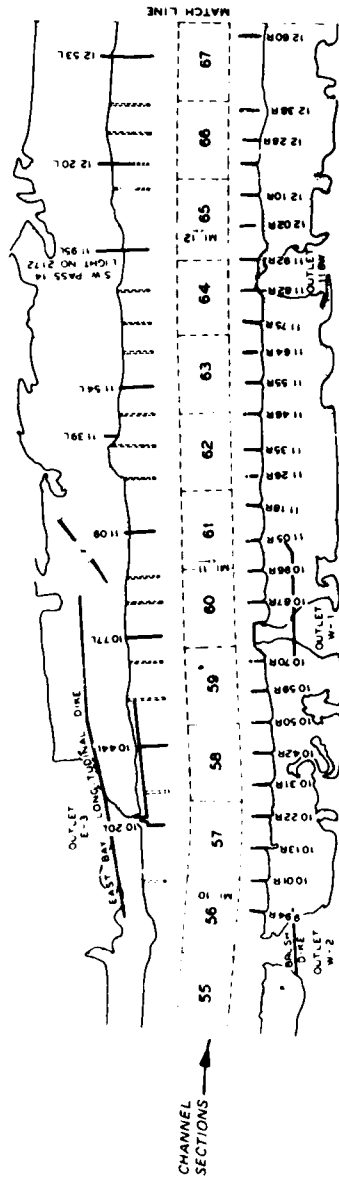
Table 30
Shoaling Indices, Relocation of Jetty Channel
Carrollton Stages 14 and 18 ft

Model Channel Sections	Base 14-ft	Plan 10		Base 18-ft	Plan 10	
	Stage cc	14-ft Stage cc	Shoaling Index	Stage cc	18-ft Stage cc	Shoaling Index
50-91	28,855	29,345	1.02	24,795	26,290	1.06
92	735	700	0.95	720	1,200	1.67
93	355	400	1.13	505	420	0.83
94	2,005	1,505	0.75	1,010	890	0.88
95	45	30	0.67	925	1,640	1.77
96	--	--	--	--	--	--
97	2,440	1,260	0.52	2,965	--	--
98	--	2,690	--	1,150	2,360	2.05
99	--	--	--	--	--	--
Total of sections 92-99	5,580	6,585	1.18	7,275	9,460	1.30
Total of sections 50-99	34,435	35,930	1.04	32,070	35,750	1.11

Note: The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.



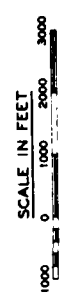


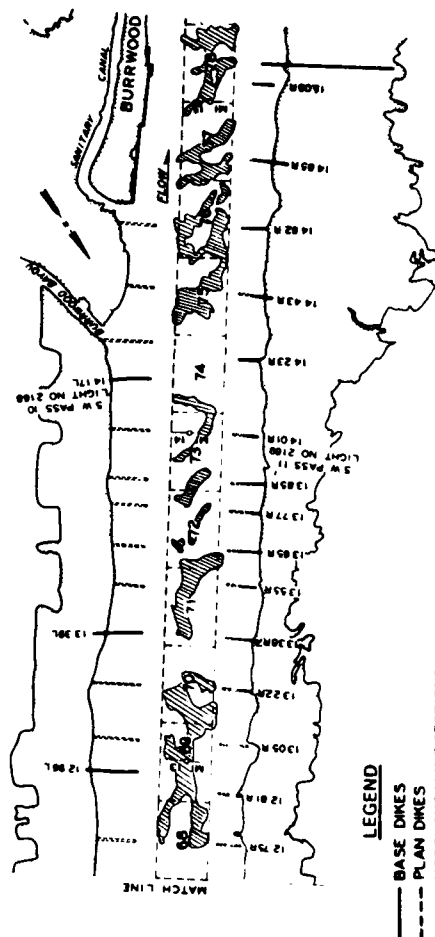
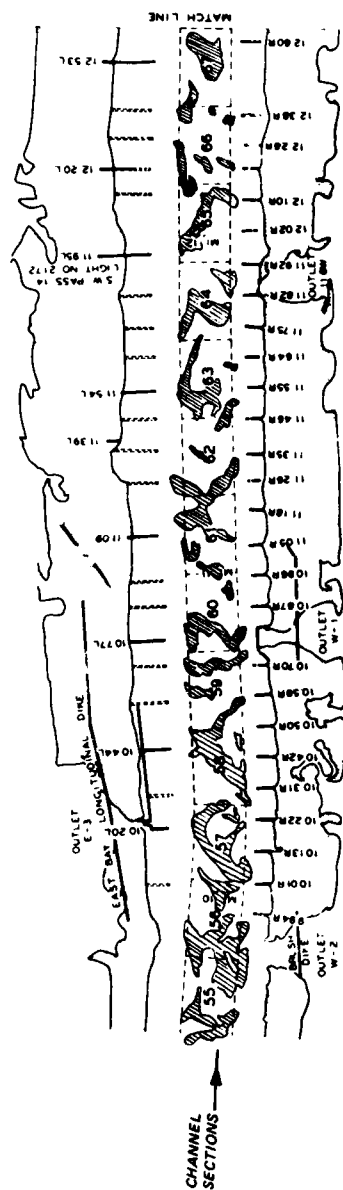


LEGEND

- BASE DIKES
- - - PLAN DIKES
- MODEL SHOALING SECTIONS
- SHOALING PATTERNS

ELEMENTS OF PLAN 1 OPPOSITE DIKES





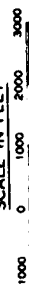
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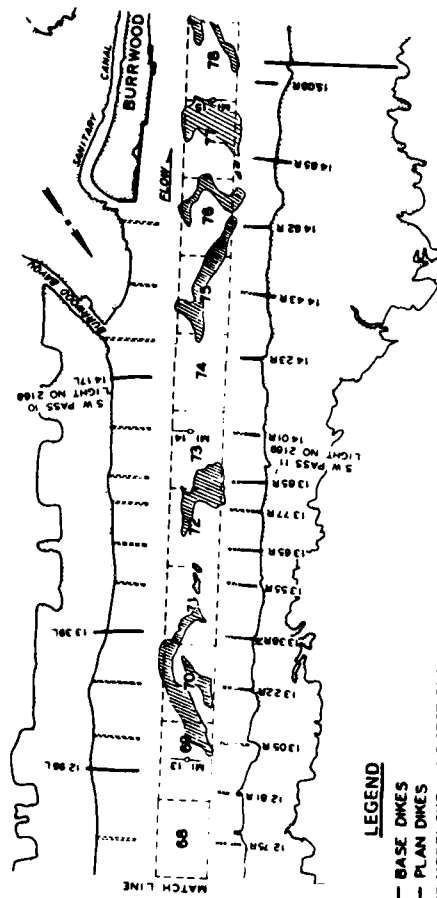
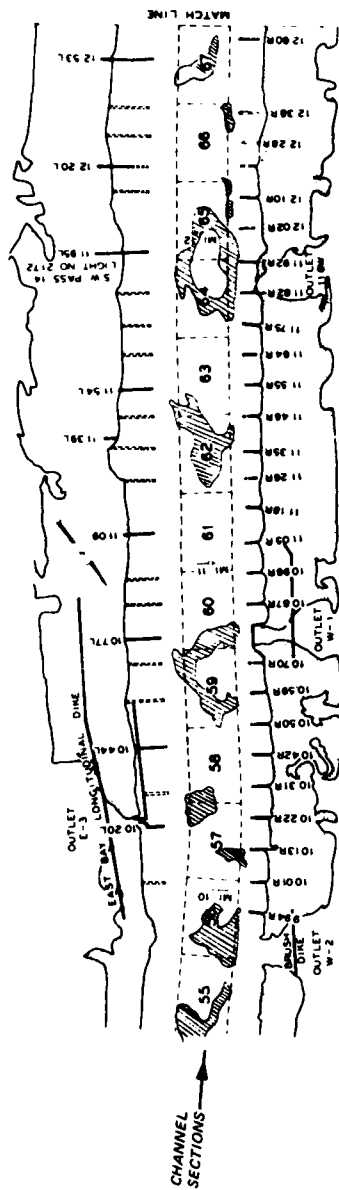
- BASE DIKES
- - - PLAN DIKES
- - - MODEL SHOALING SECTIONS
- SHOALING PATTERNS

SHOALING PATTERN PLAN 1 OPPOSITE DIKES

10-FT STAGE

SCALE IN FEET

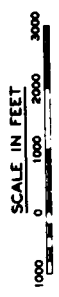




- LEGEND**
- BASE DIKES
 - - - PLAN DIKES
 - ▨ MODEL SHOALING SECTIONS
 - ▨ SHOALING PATTERNS

SHOALING PATTERN PLAN 1 OPPOSITE DIKES

14-FT STAGE



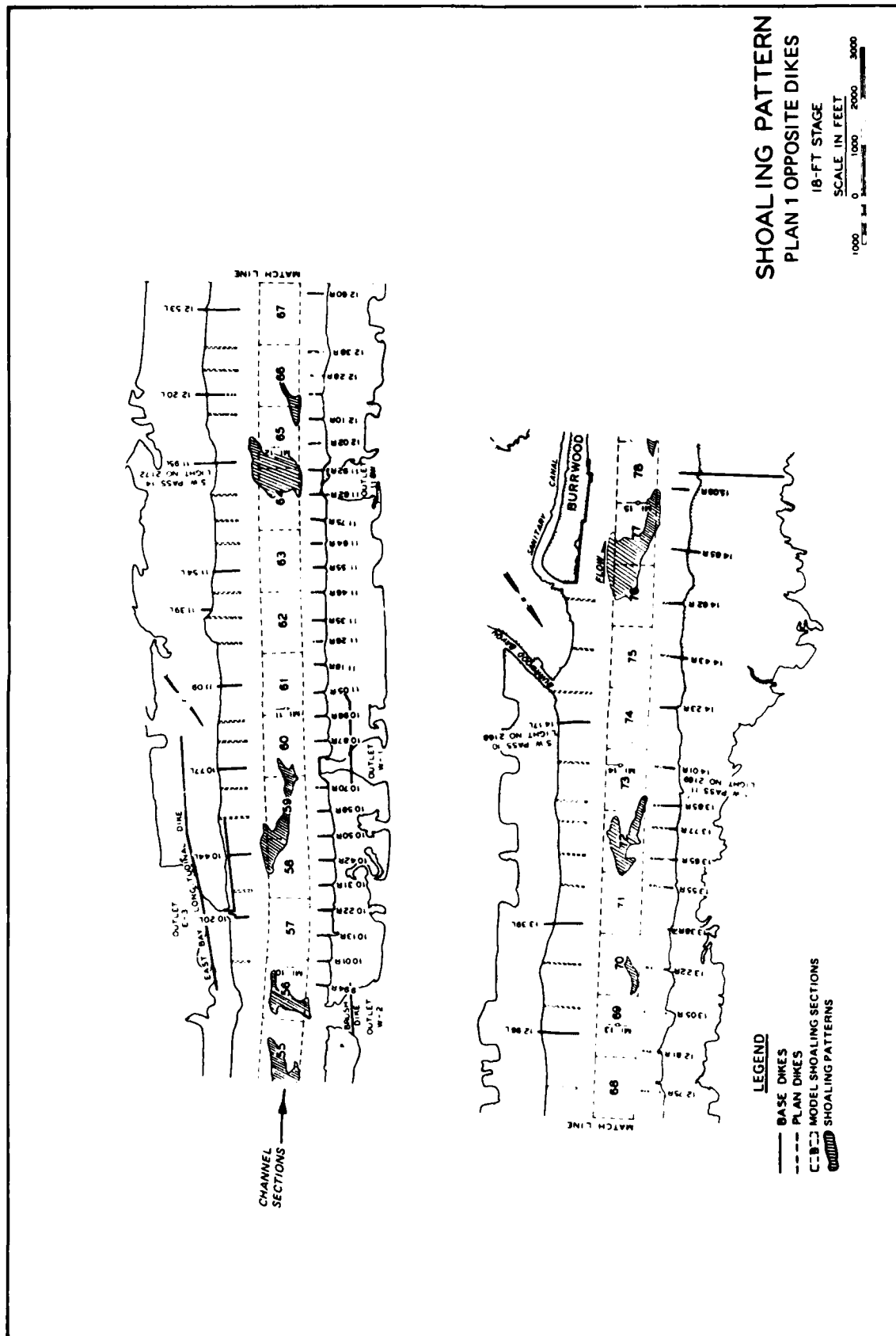


PLATE 8

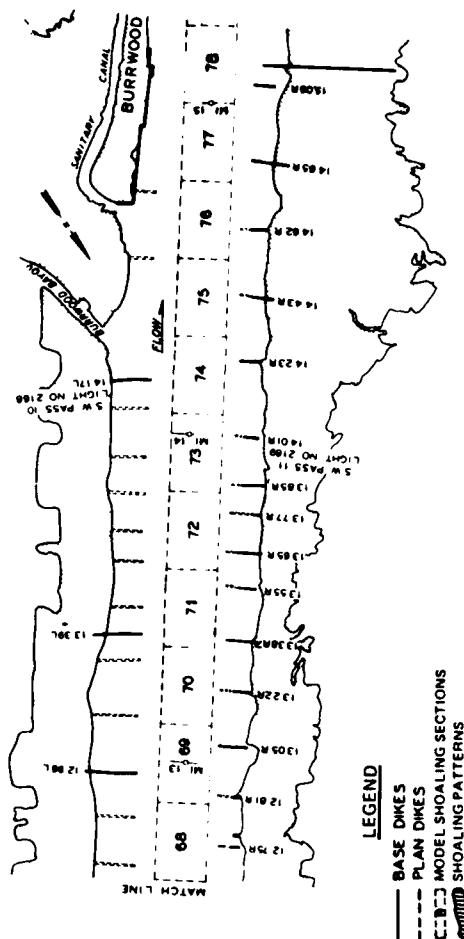
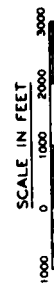
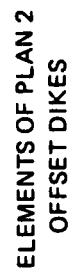
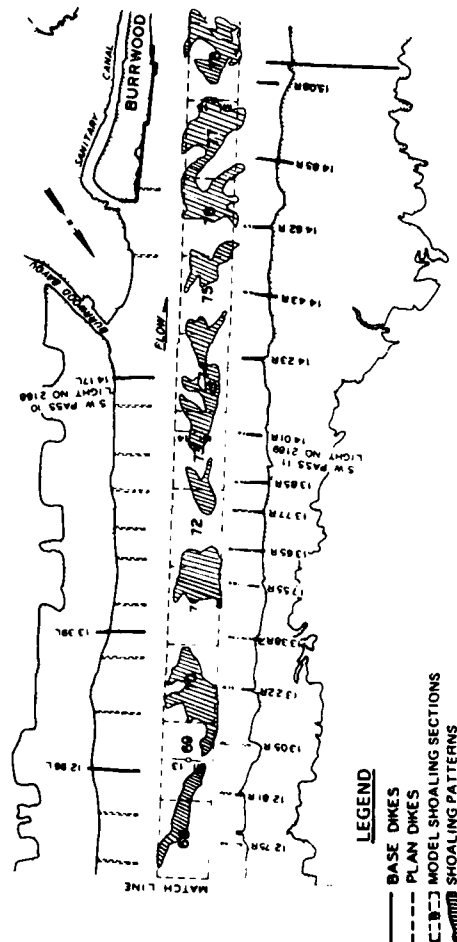
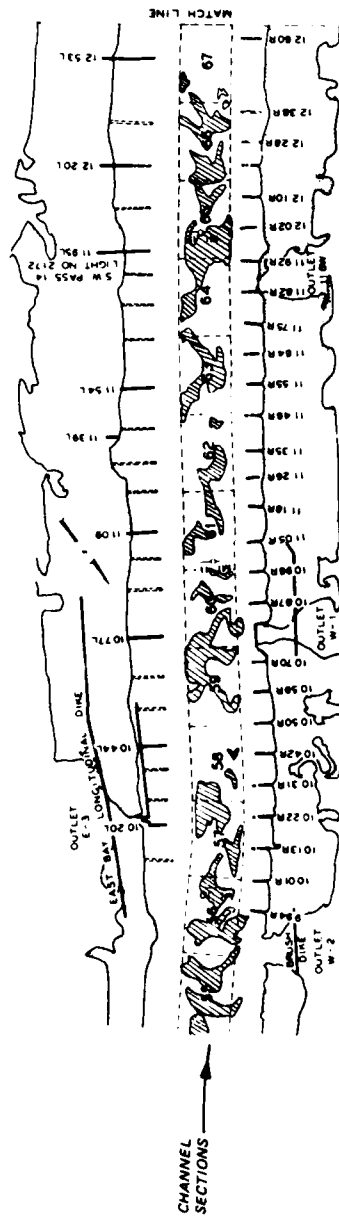


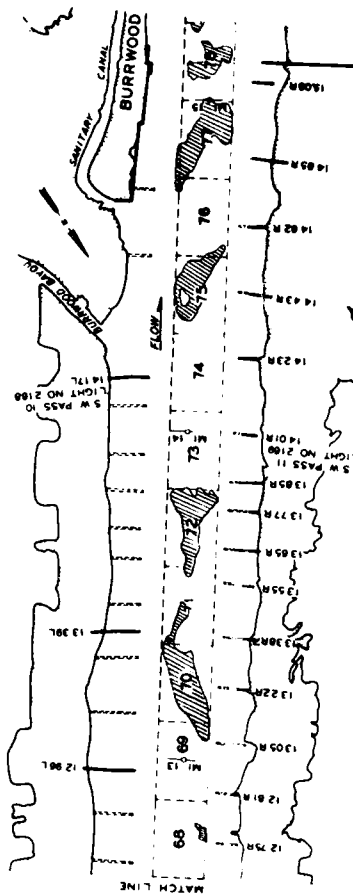
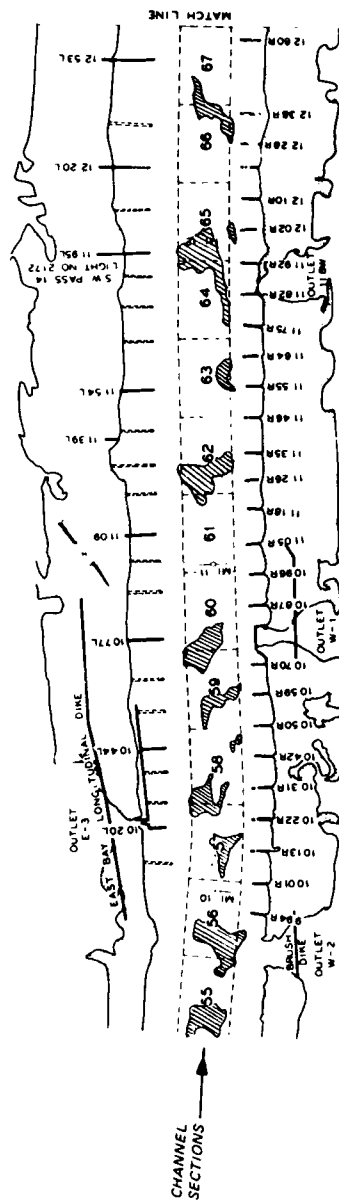
PLATE 9



- LEGEND**
- BASE DIKES
 - - - PLAN DIKES
 - ▨ MODEL SHOALING SECTIONS
 - ▨ SHOALING PATTERNS

**SHOALING PATTERN
PLAN 2 OFFSET DIKES**

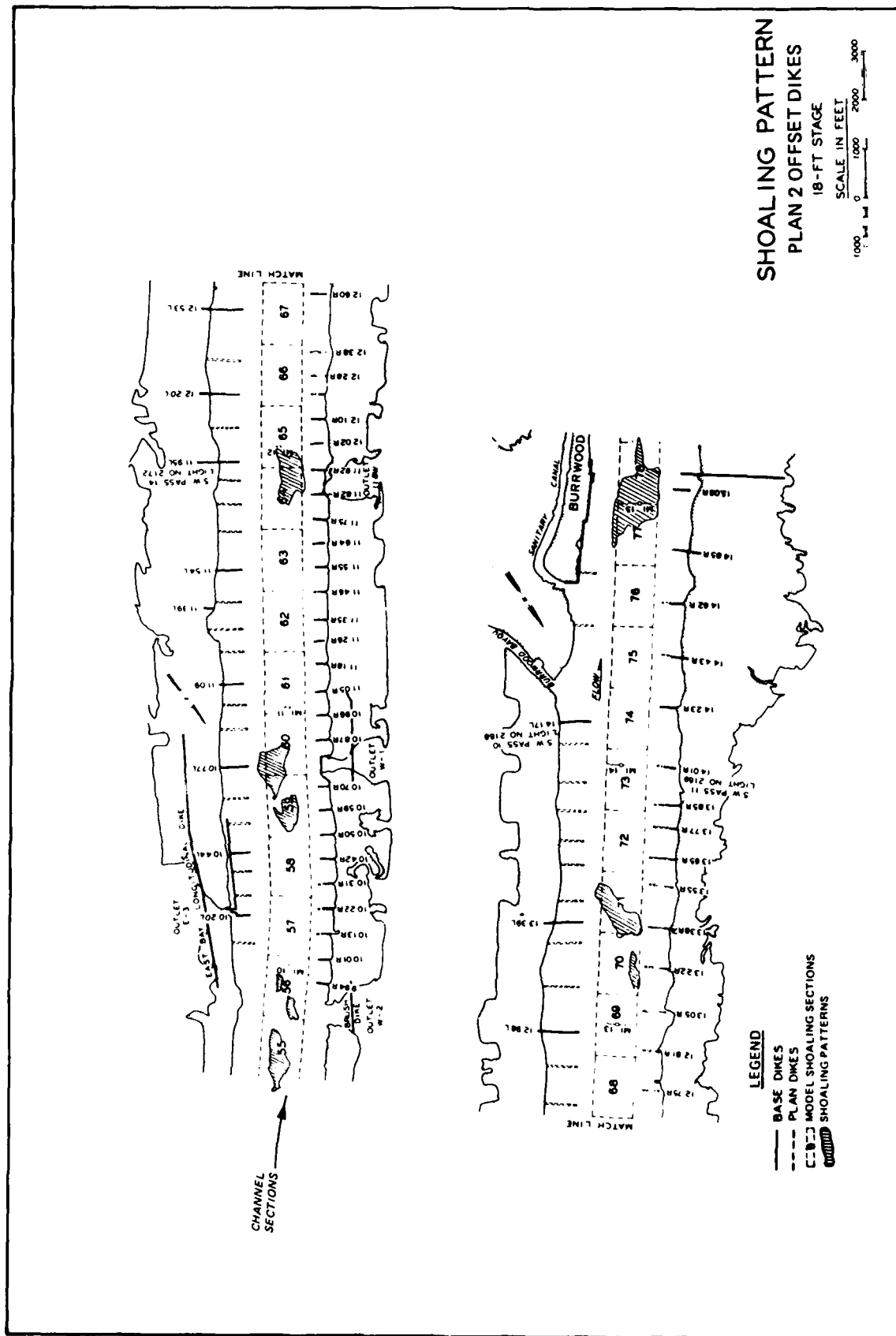
10-FT STAGE
SCALE IN FEET
0 1000 2000 3000

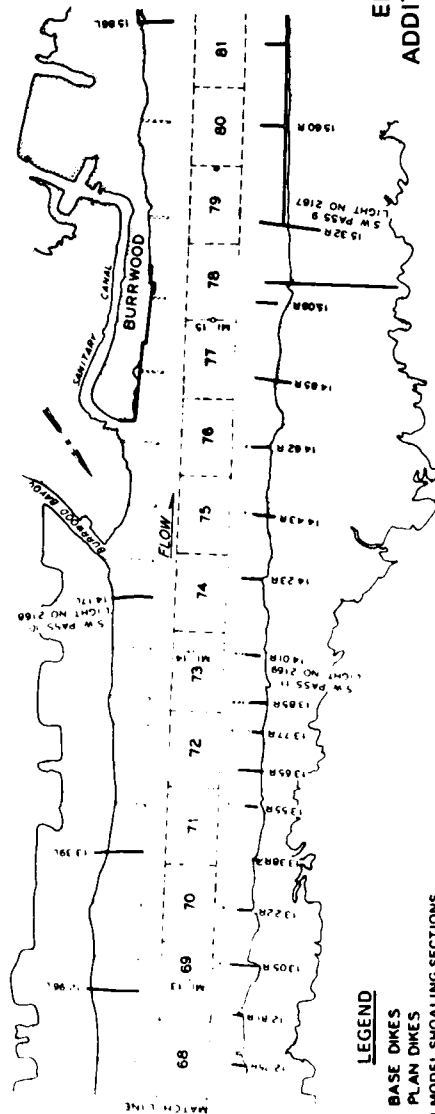
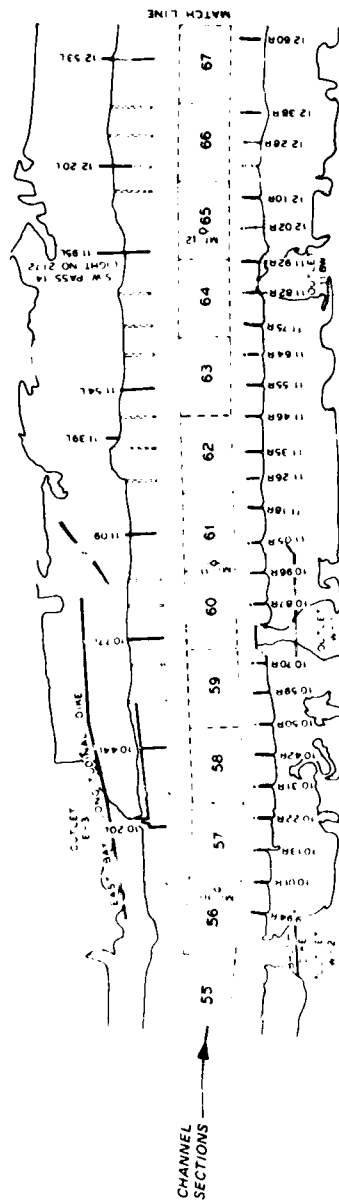


LEGEND
 --- BASE DIKES
 --- PLAN DIKES
 --- MODEL SHOALING SECTIONS
 [Hatched Area] SHOALING PATTERNS

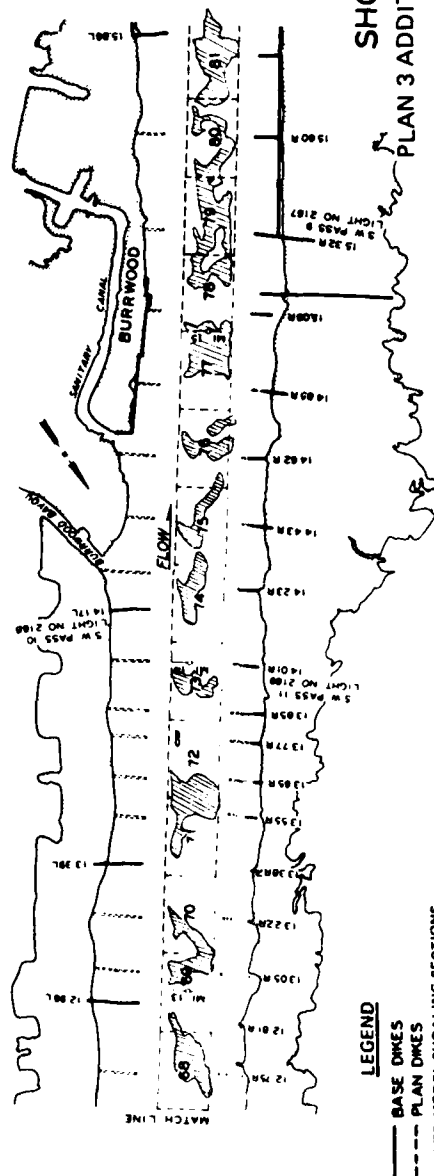
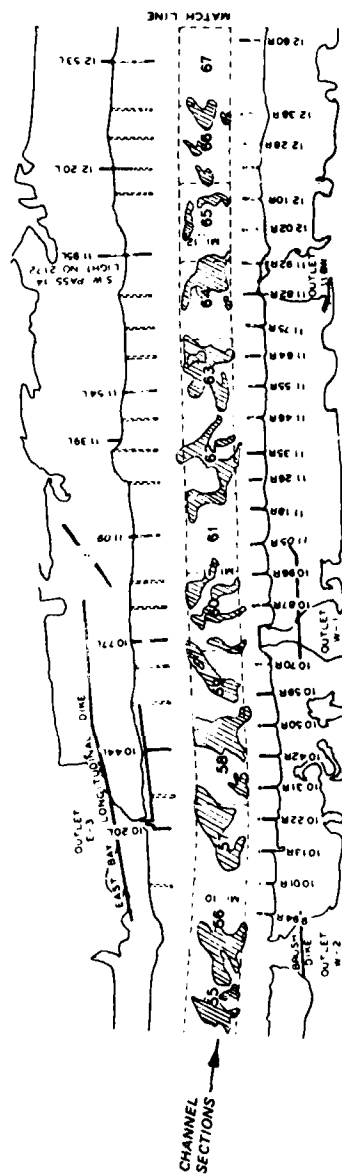
SHOALING PATTERN PLAN 2 OFFSET DIKES 14-FT STAGE

SCALE IN FEET
 0 1000 2000 3000





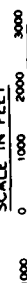
ELEMENTS OF PLAN 3
ADDITIONAL OPPOSITE DIKES



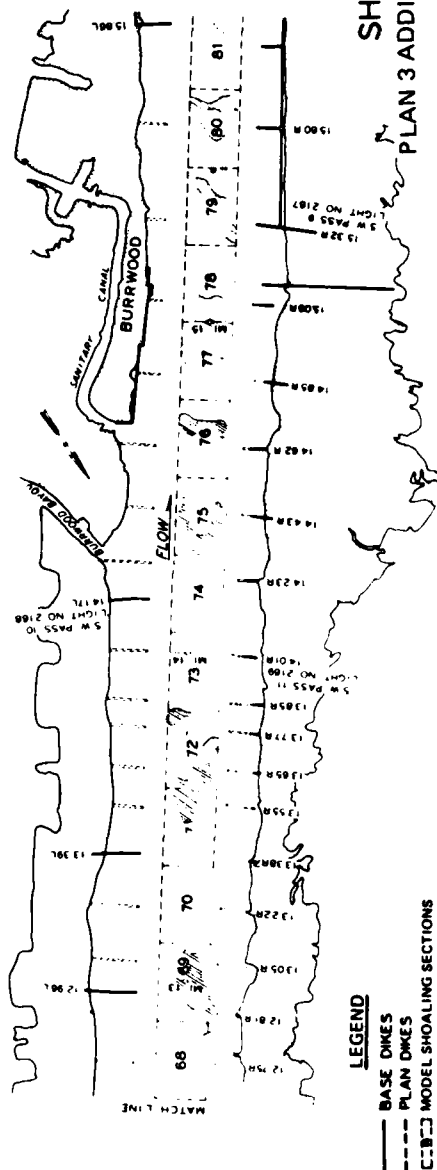
SHOALING PATTERN PLAN 3 ADDITIONAL OPPOSITE DIKES

10-FT STAGE

SCALE IN FEET



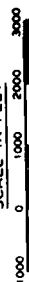
- BASE DIKES
- - - PLAN DIKES
- ▨ MODEL SHOALING SECTIONS
- ▨ SHOALING PATTERNS



SHOALING PATTERN PLAN 3 ADDITIONAL OPPOSITE DIKES

14-FT STAGE

SCALE IN FEET



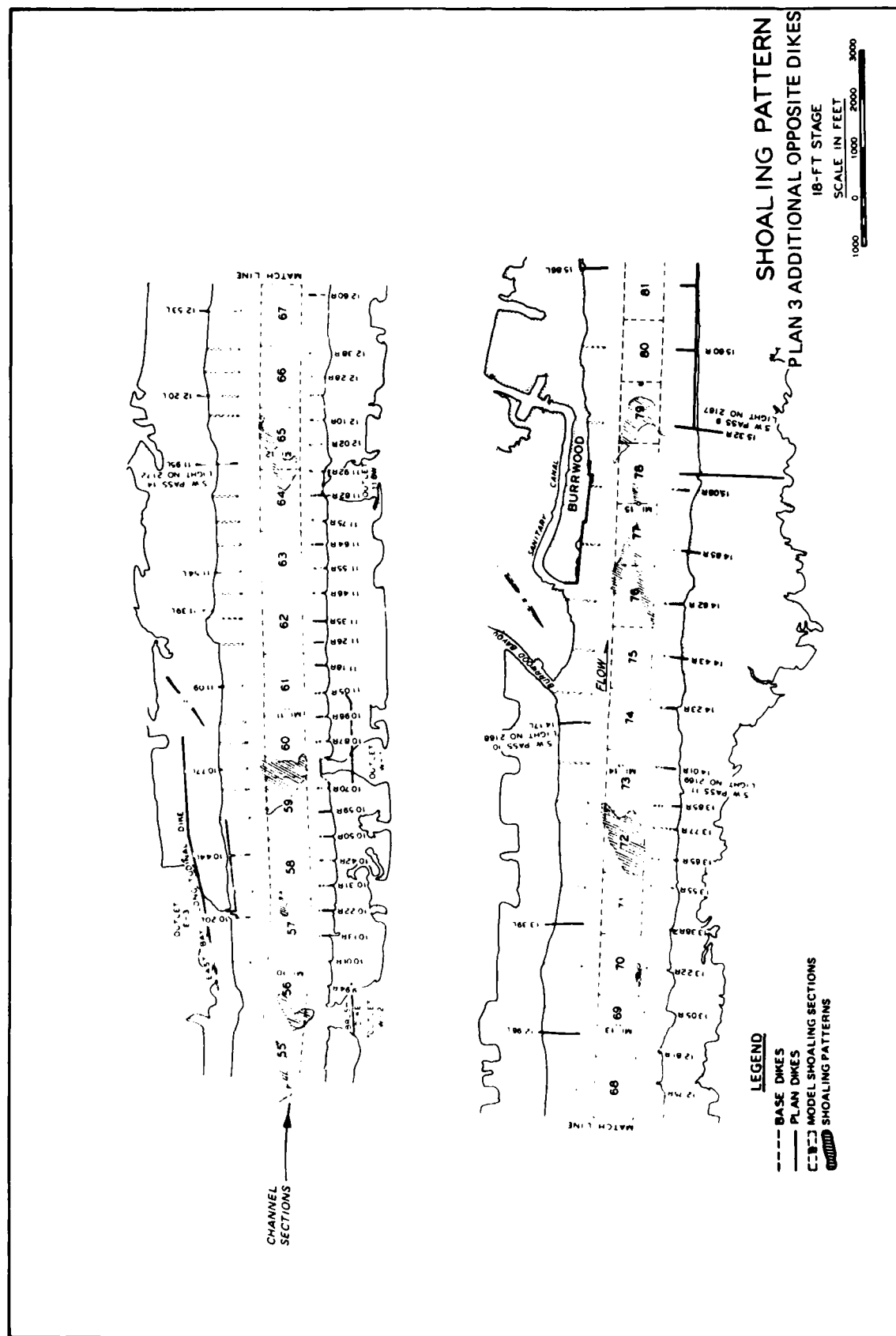
LEGEND

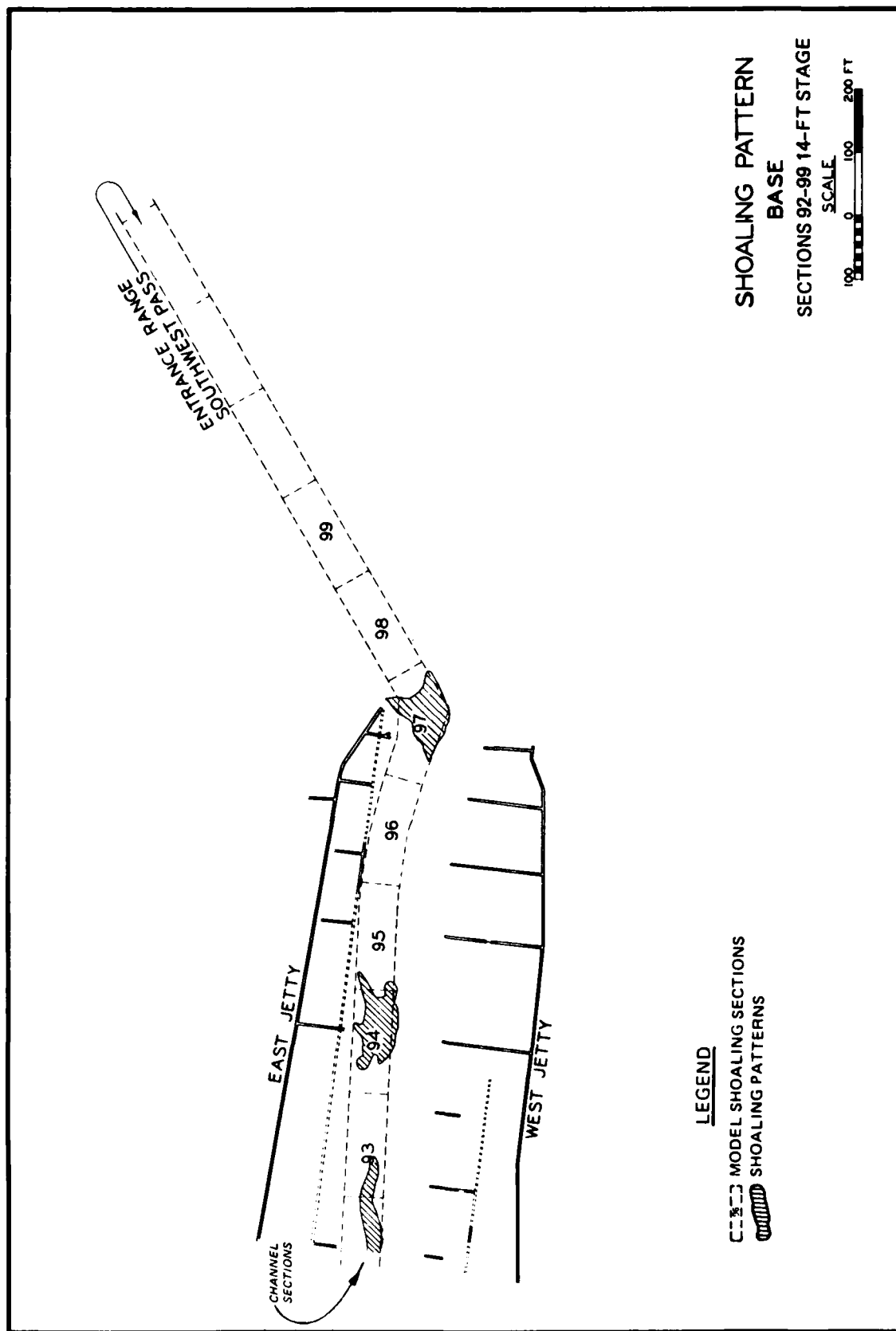
BASE DIKES

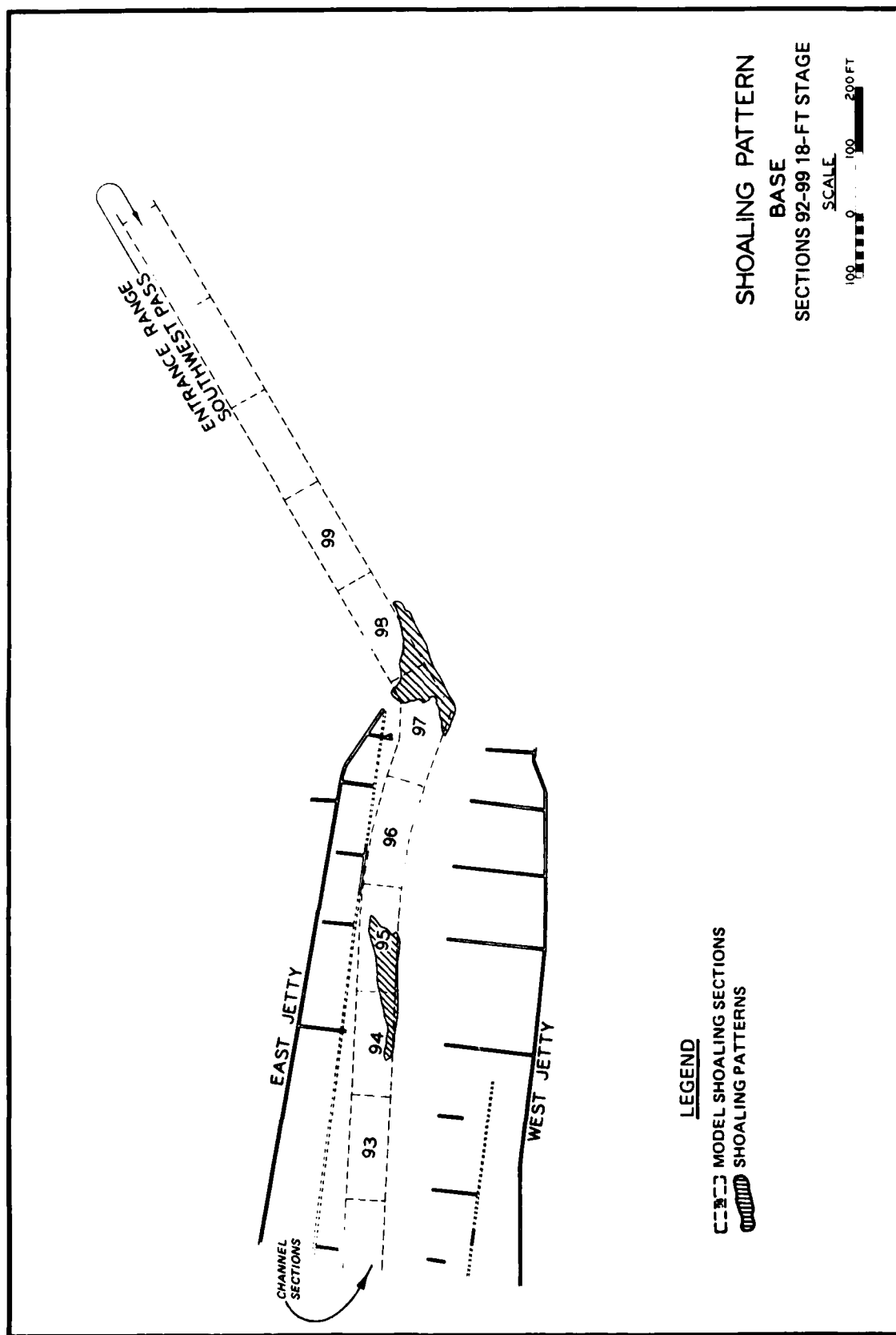
PLAN Dikes

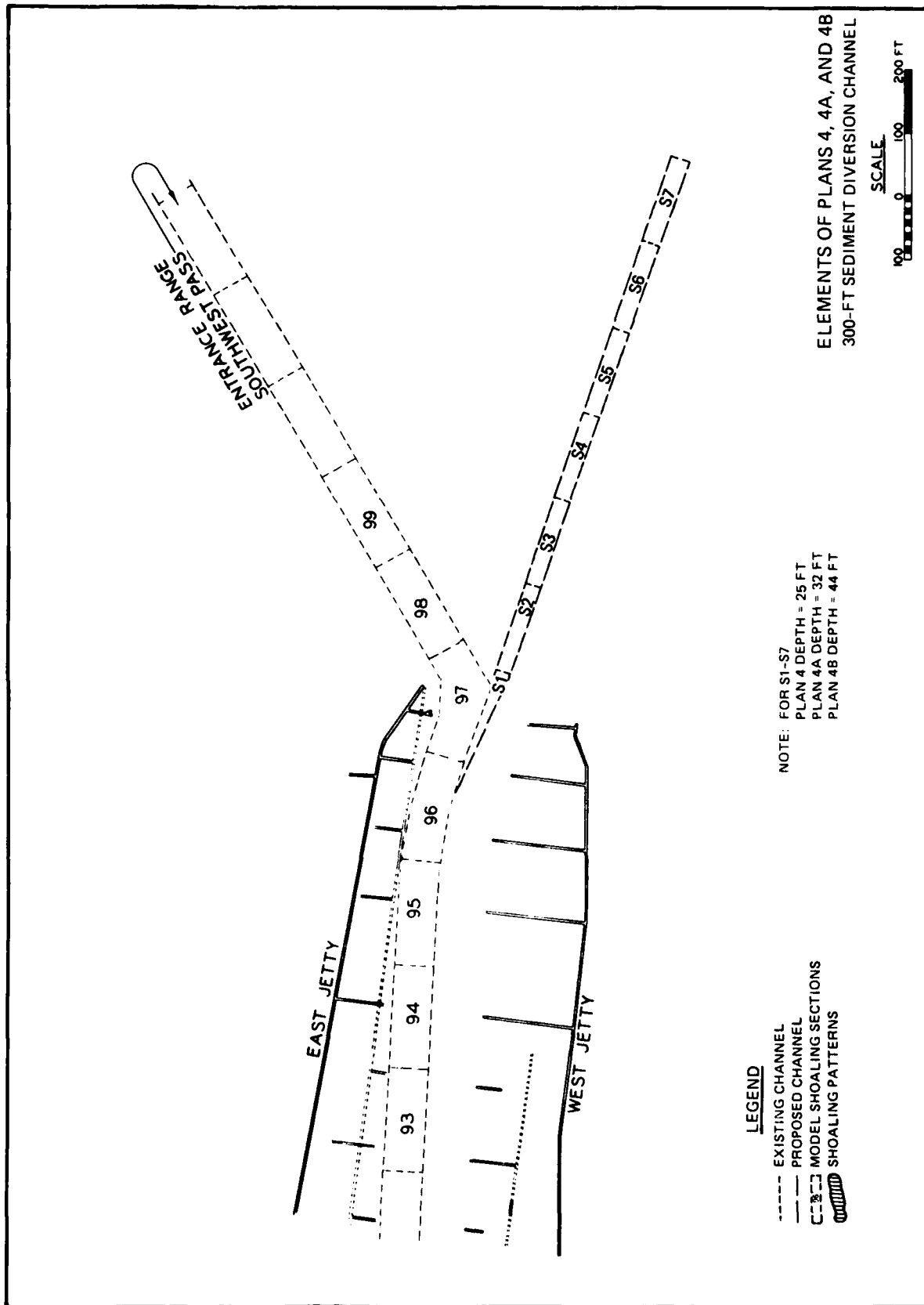
MODEL SHOALING SECTIONS

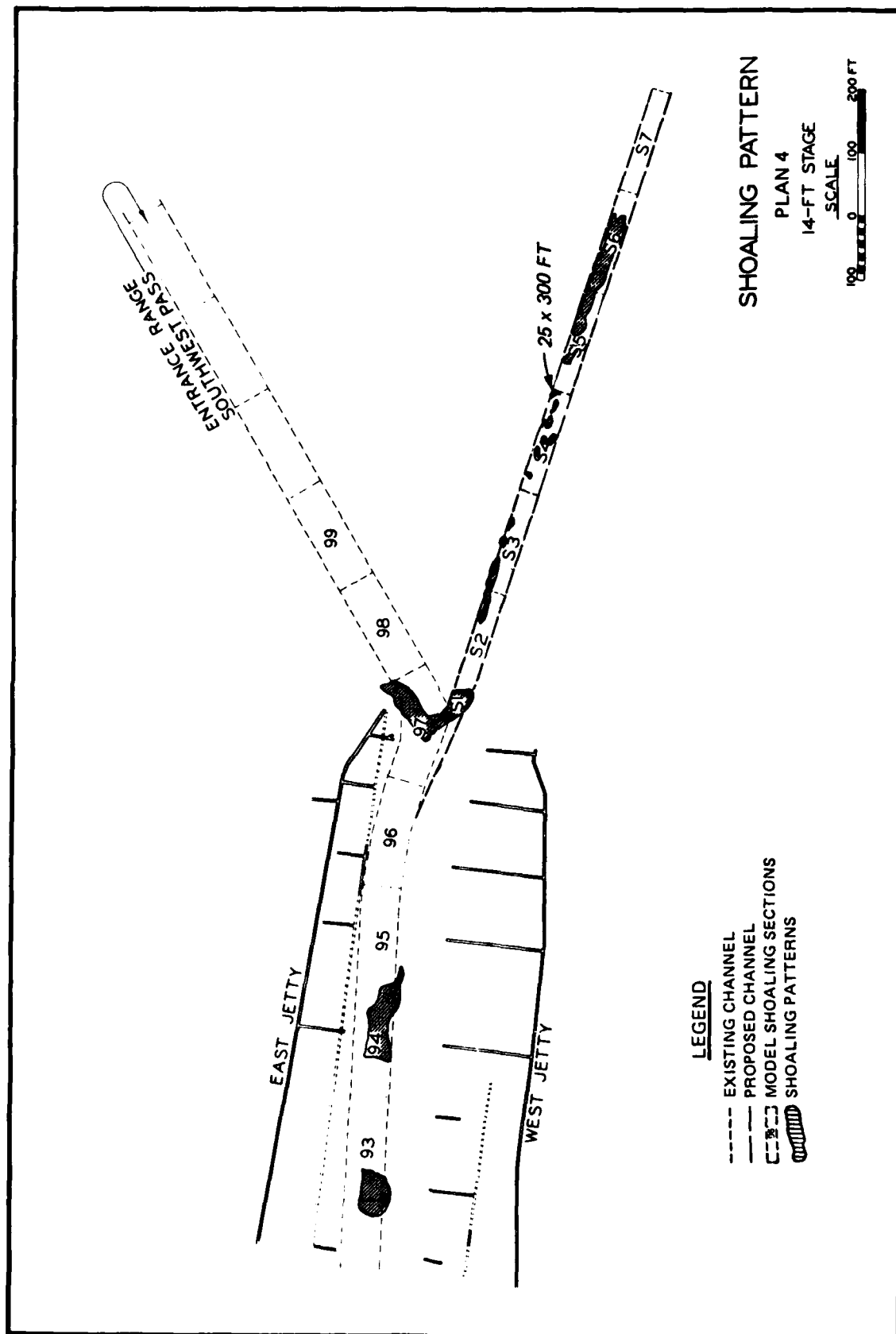
SHC-2 LING PATTERNS

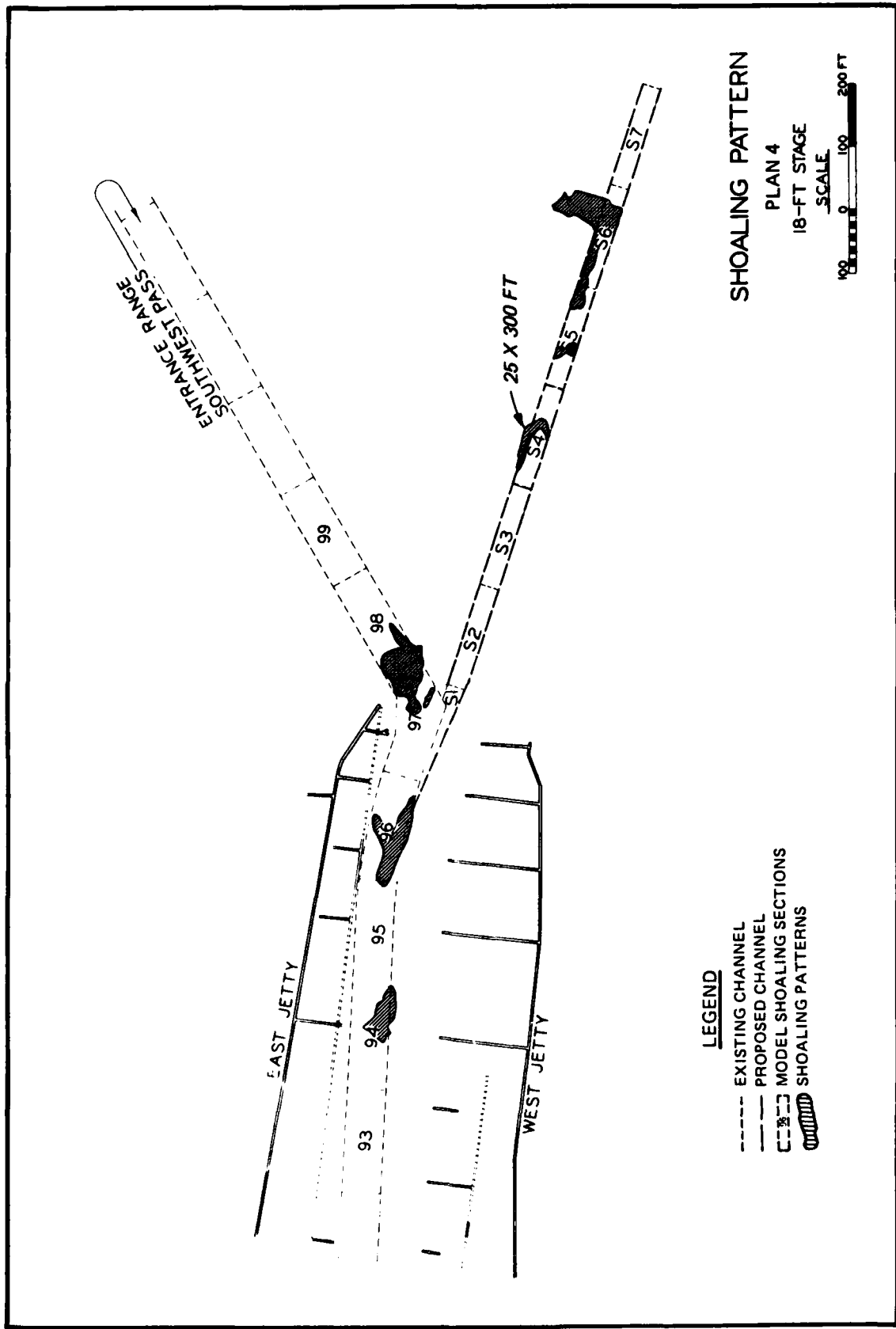












SHOALING PATTERN

PLAN 4

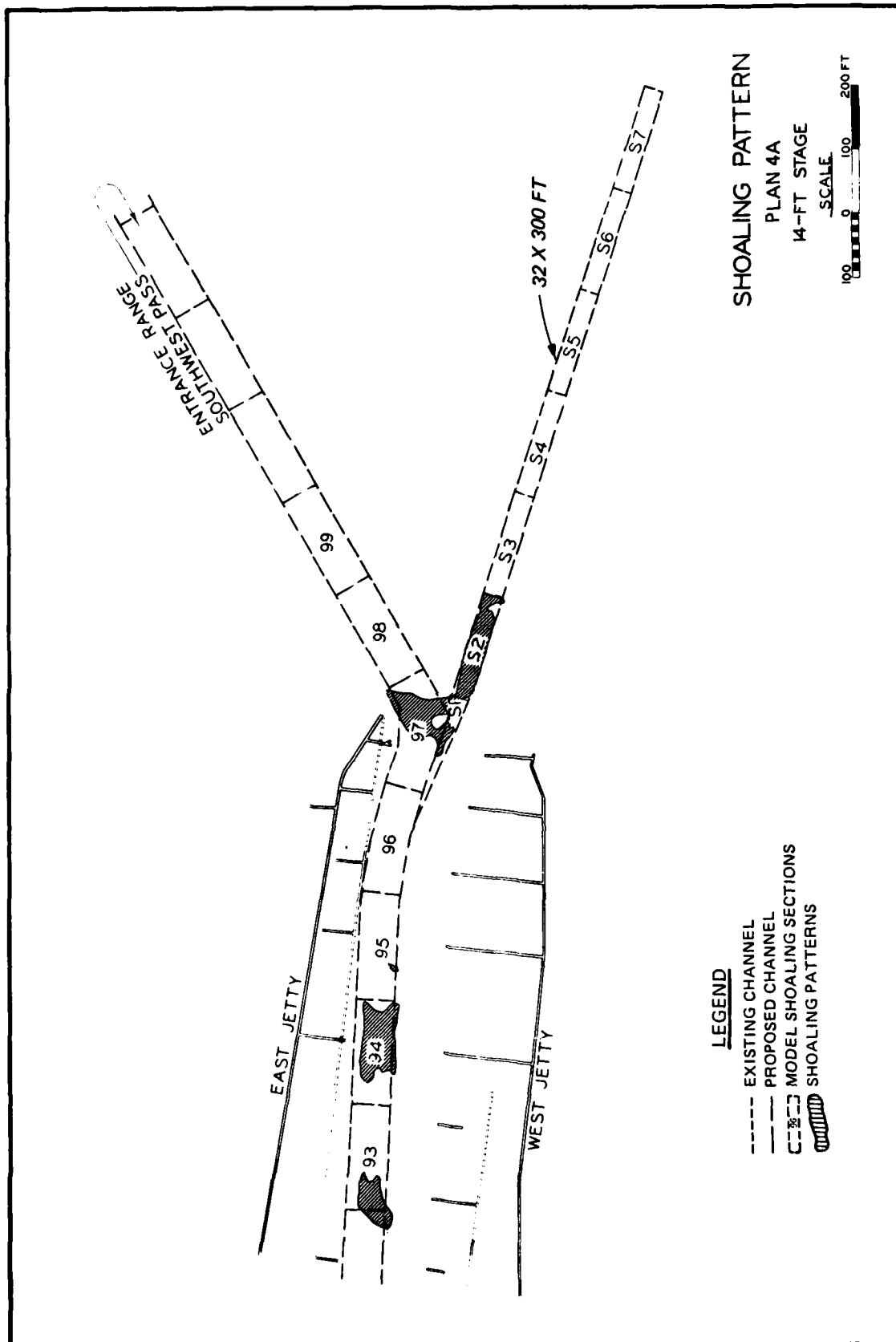
18-FT STAGE

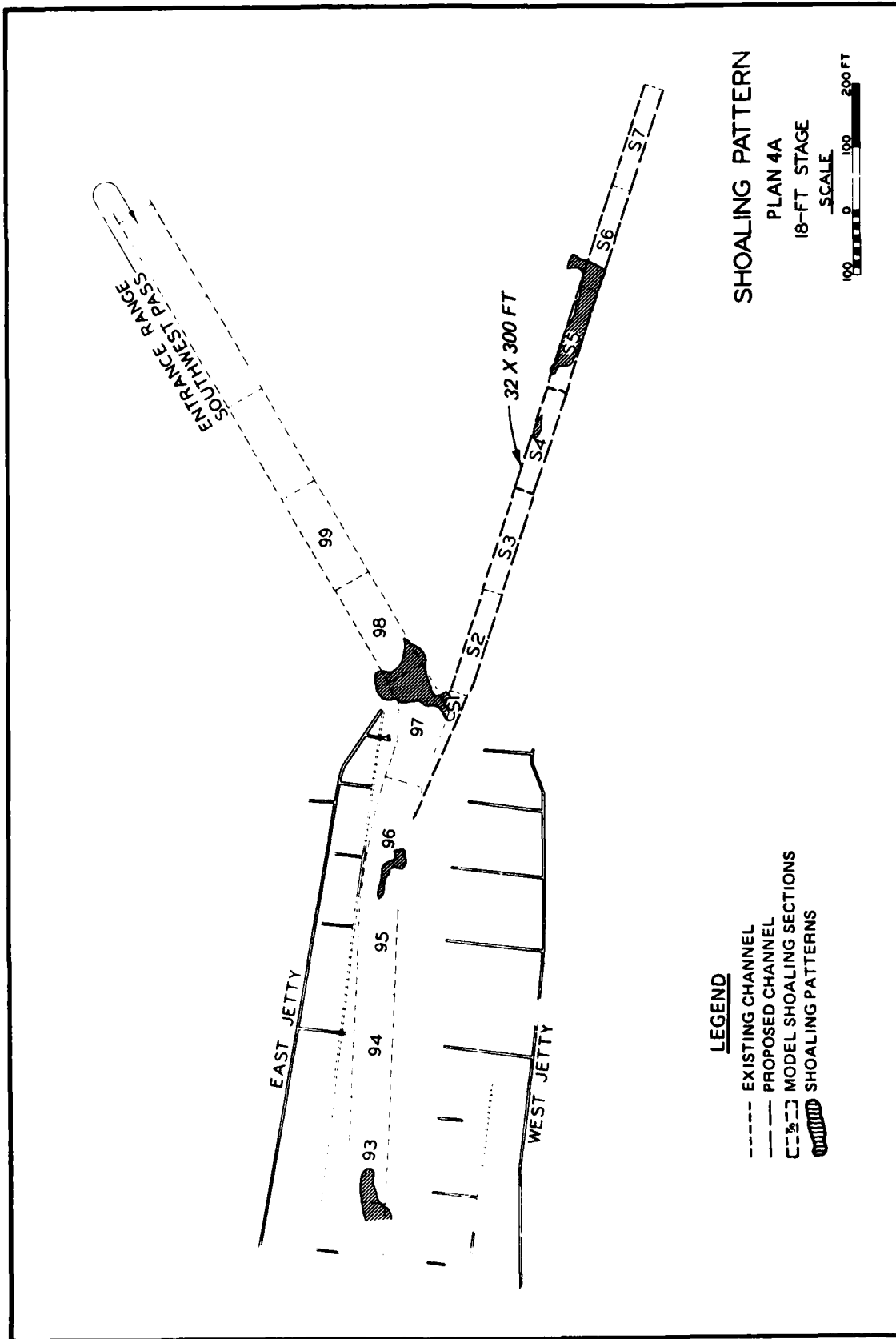
SCALE



LEGEND

- EXISTING CHANNEL
- - - PROPOSED CHANNEL
- [---] MODEL SHOALING SECTIONS
- [Hatched] SHOALING PATTERNS





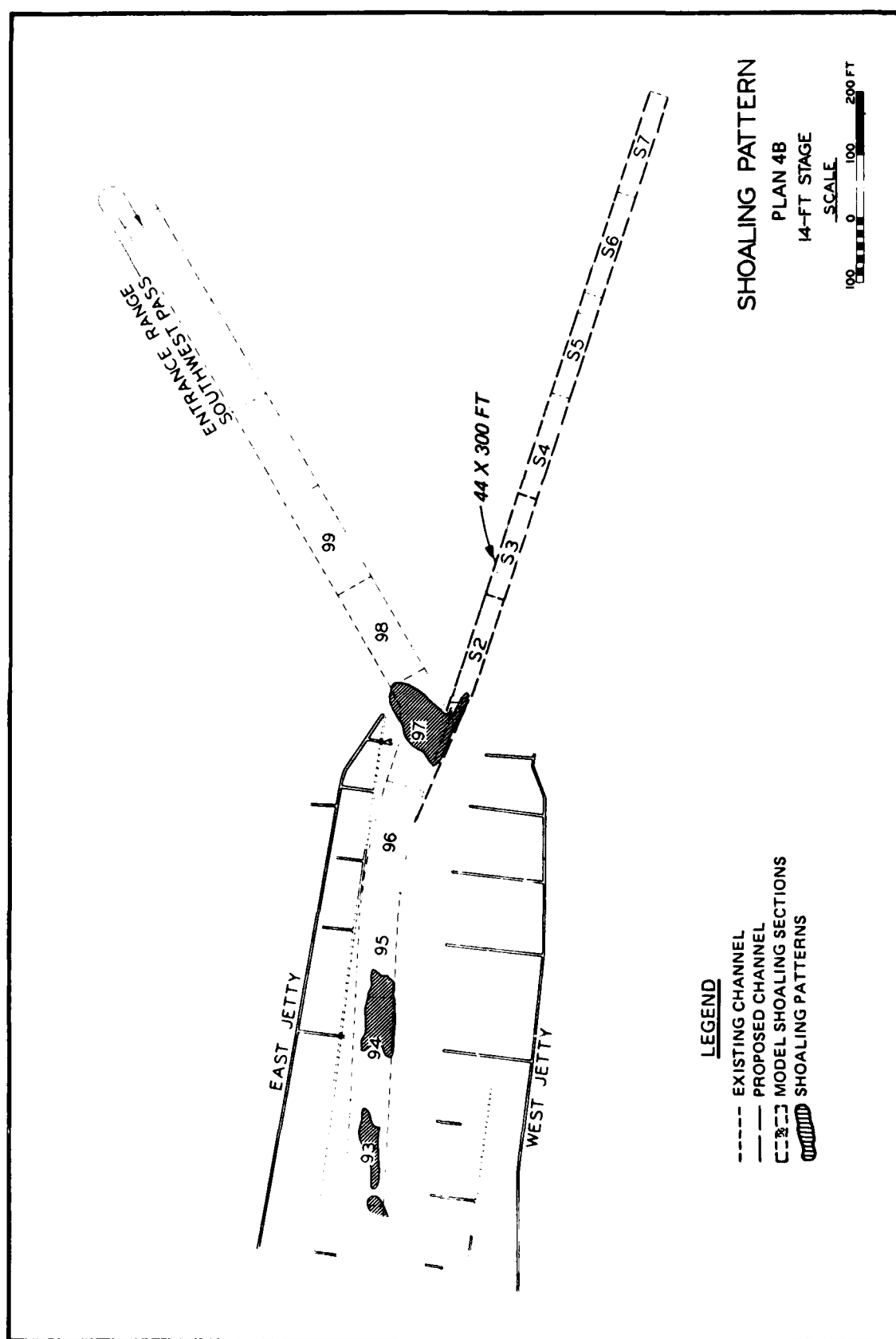
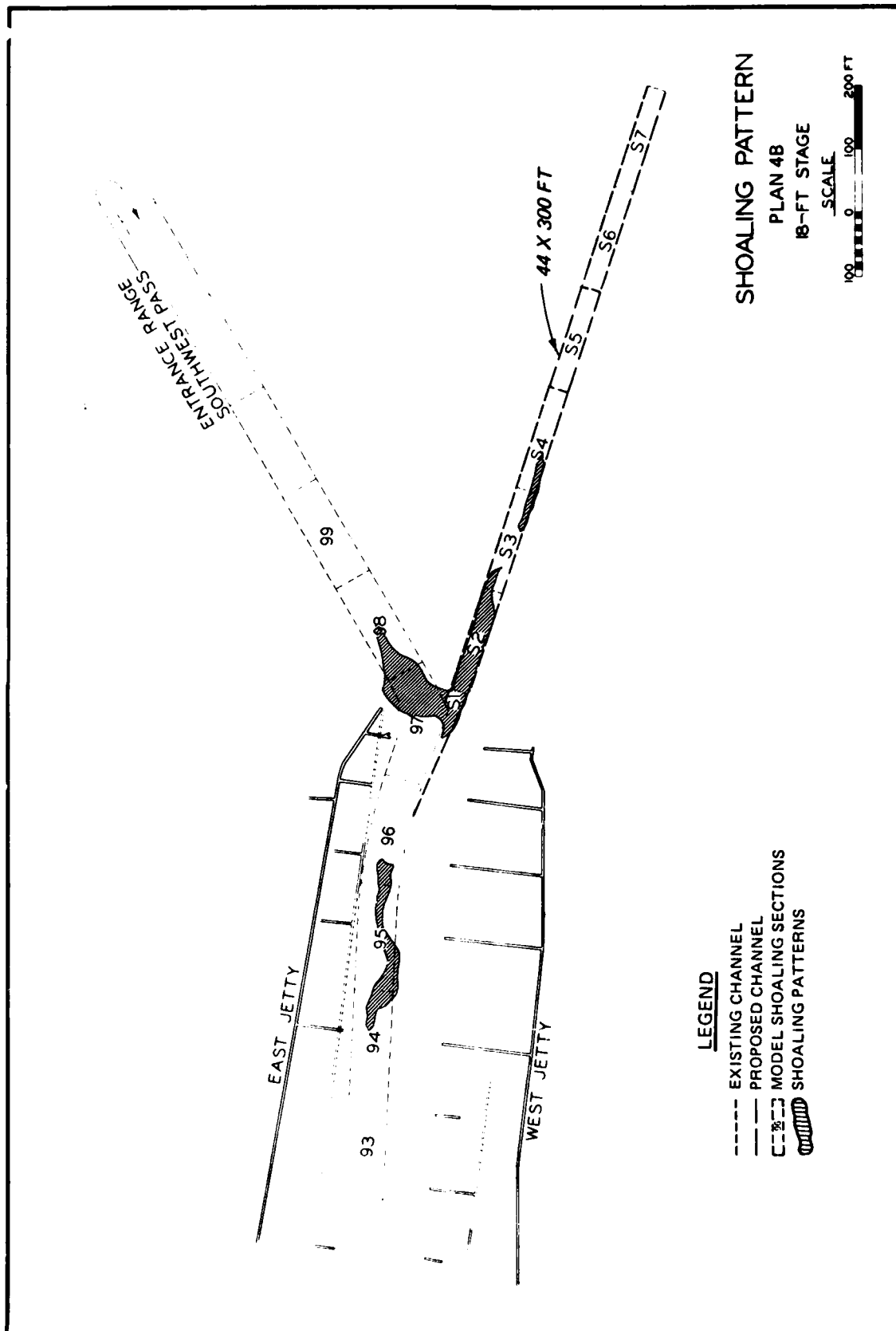
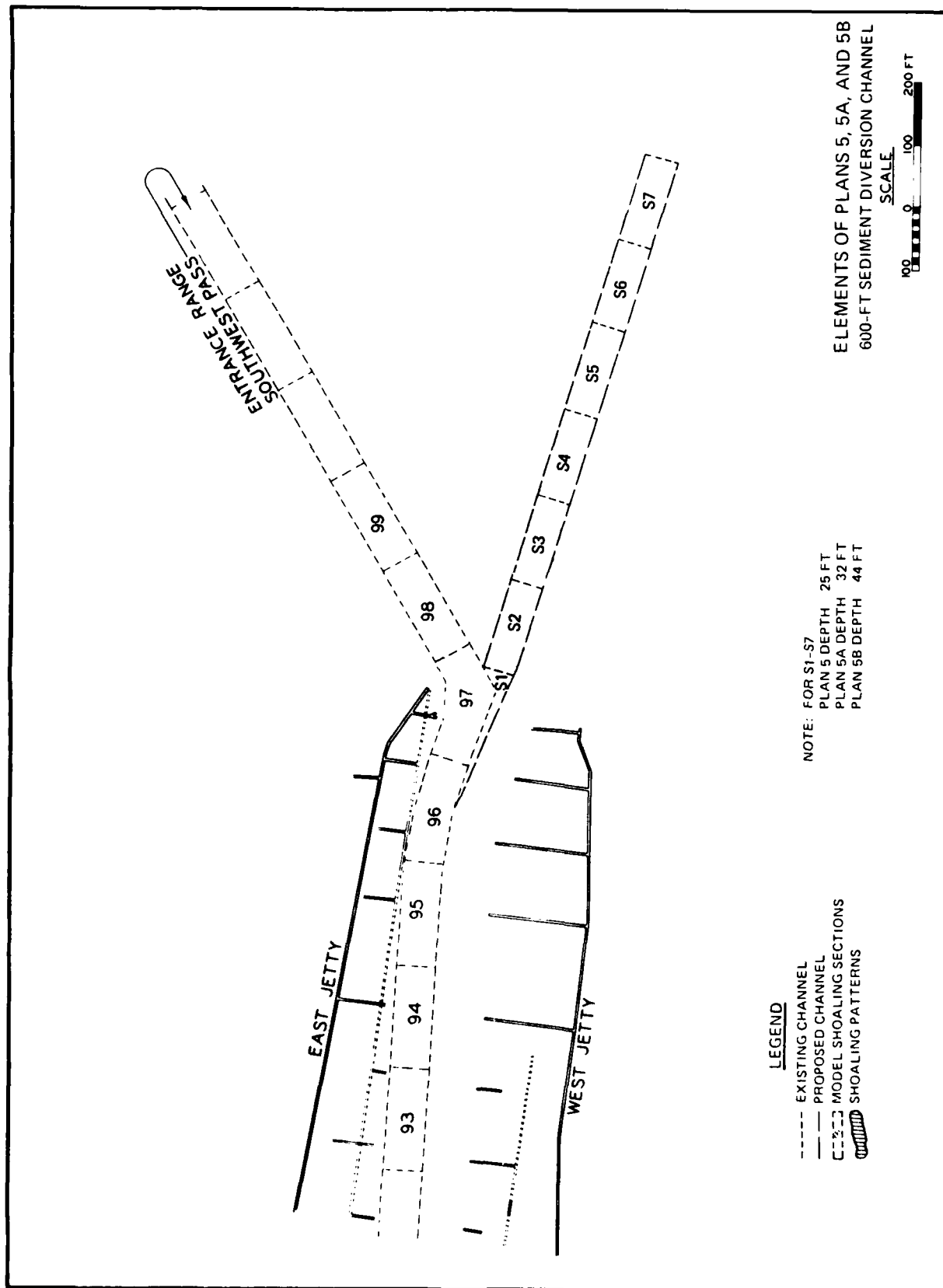
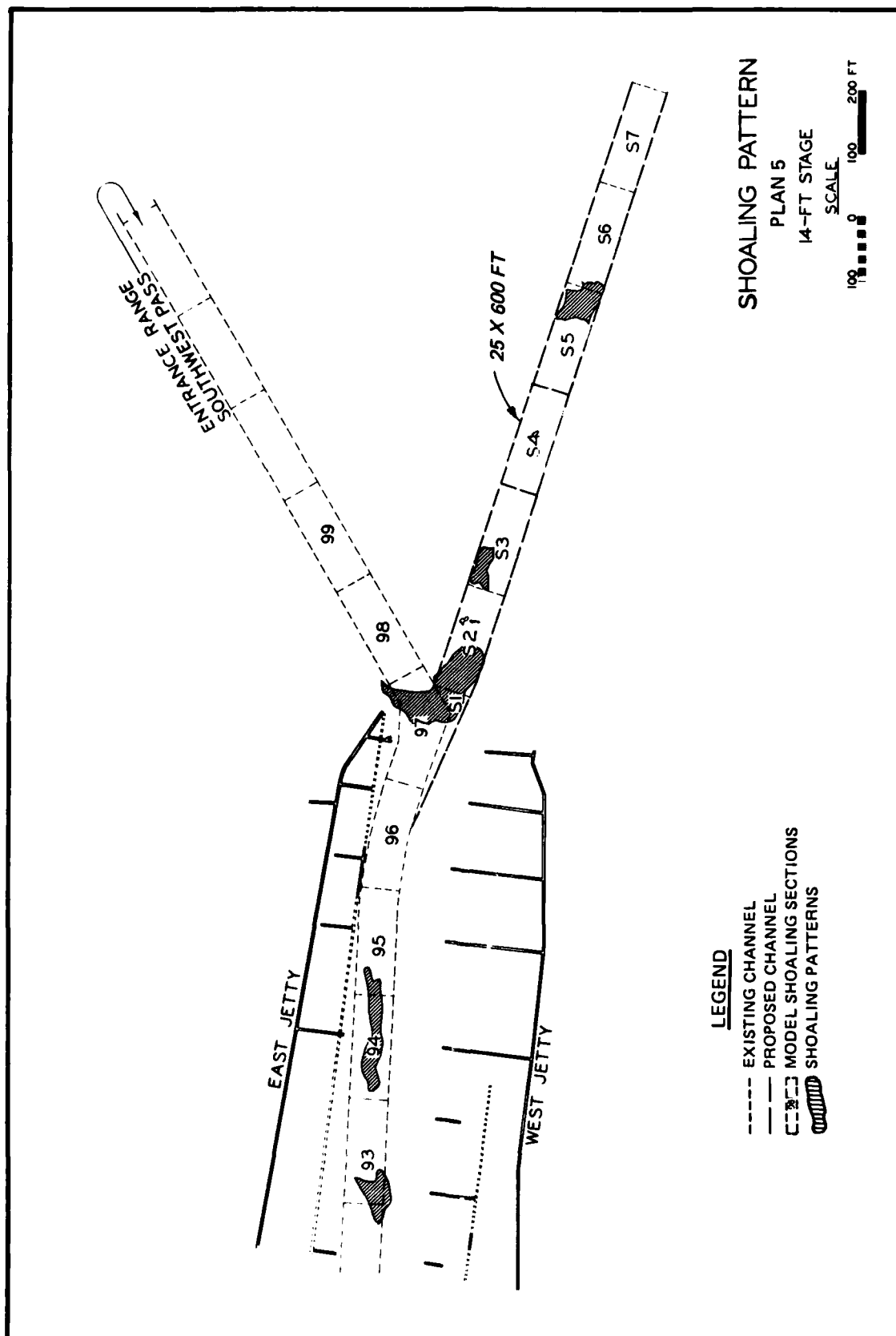


PLATE 24







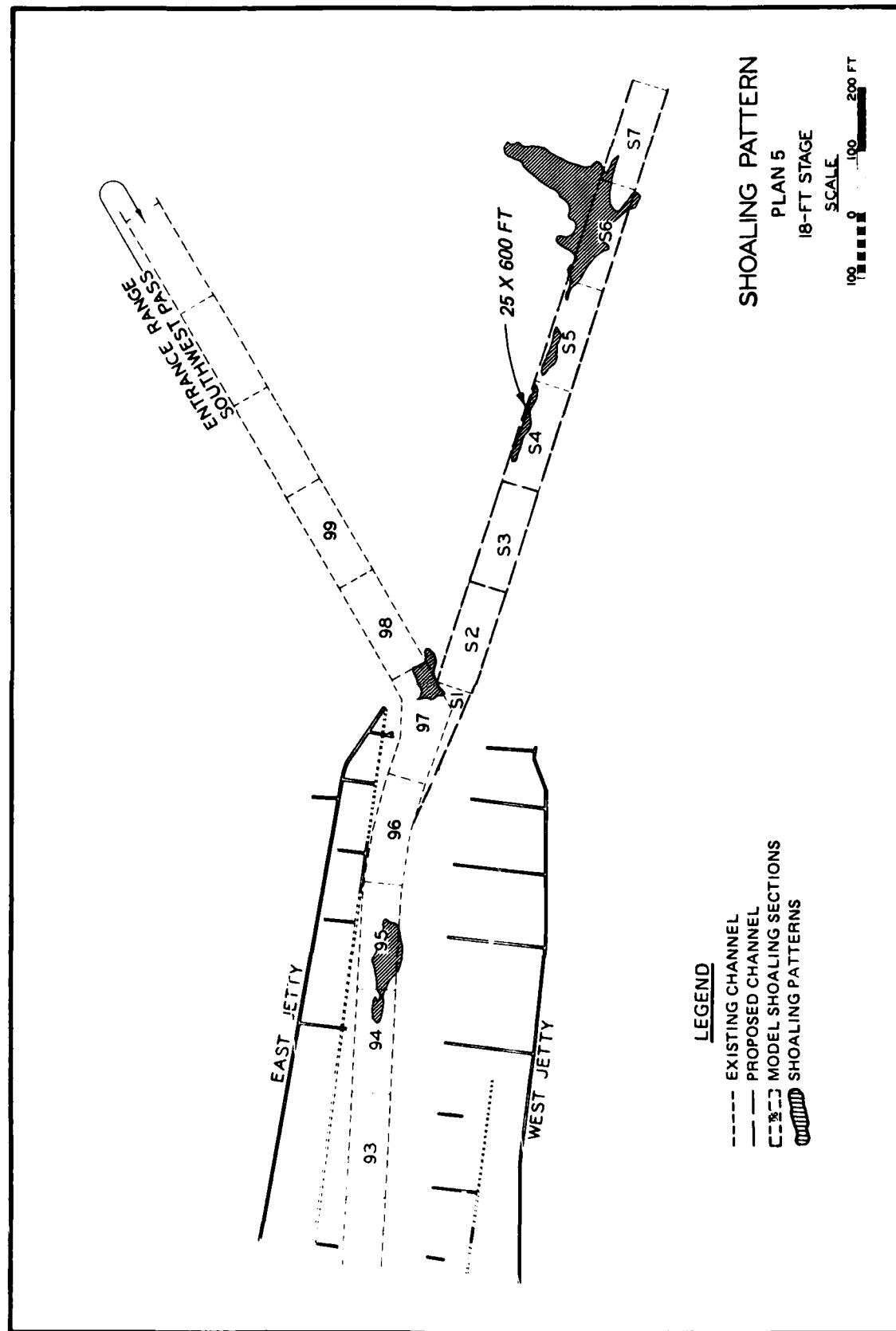
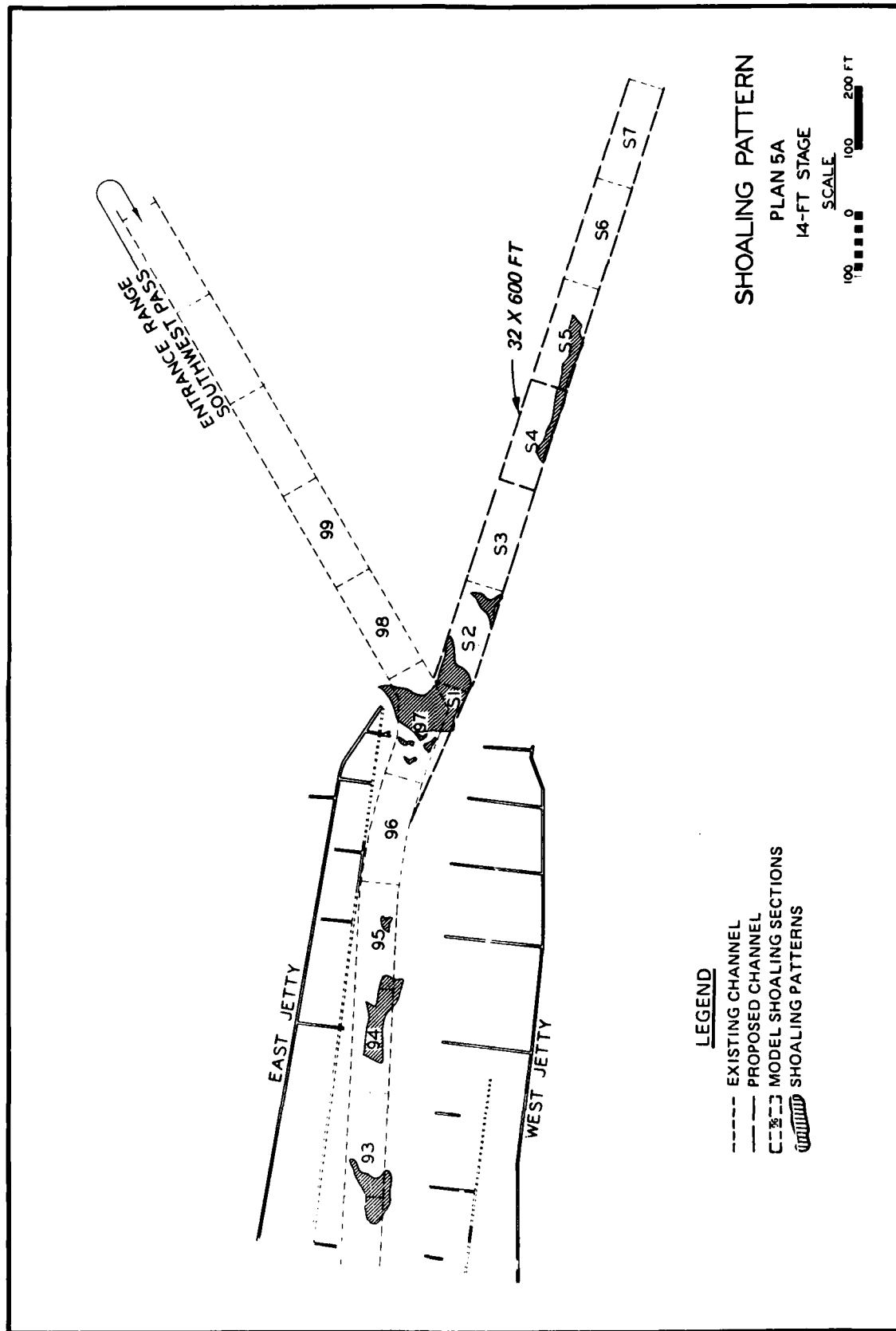
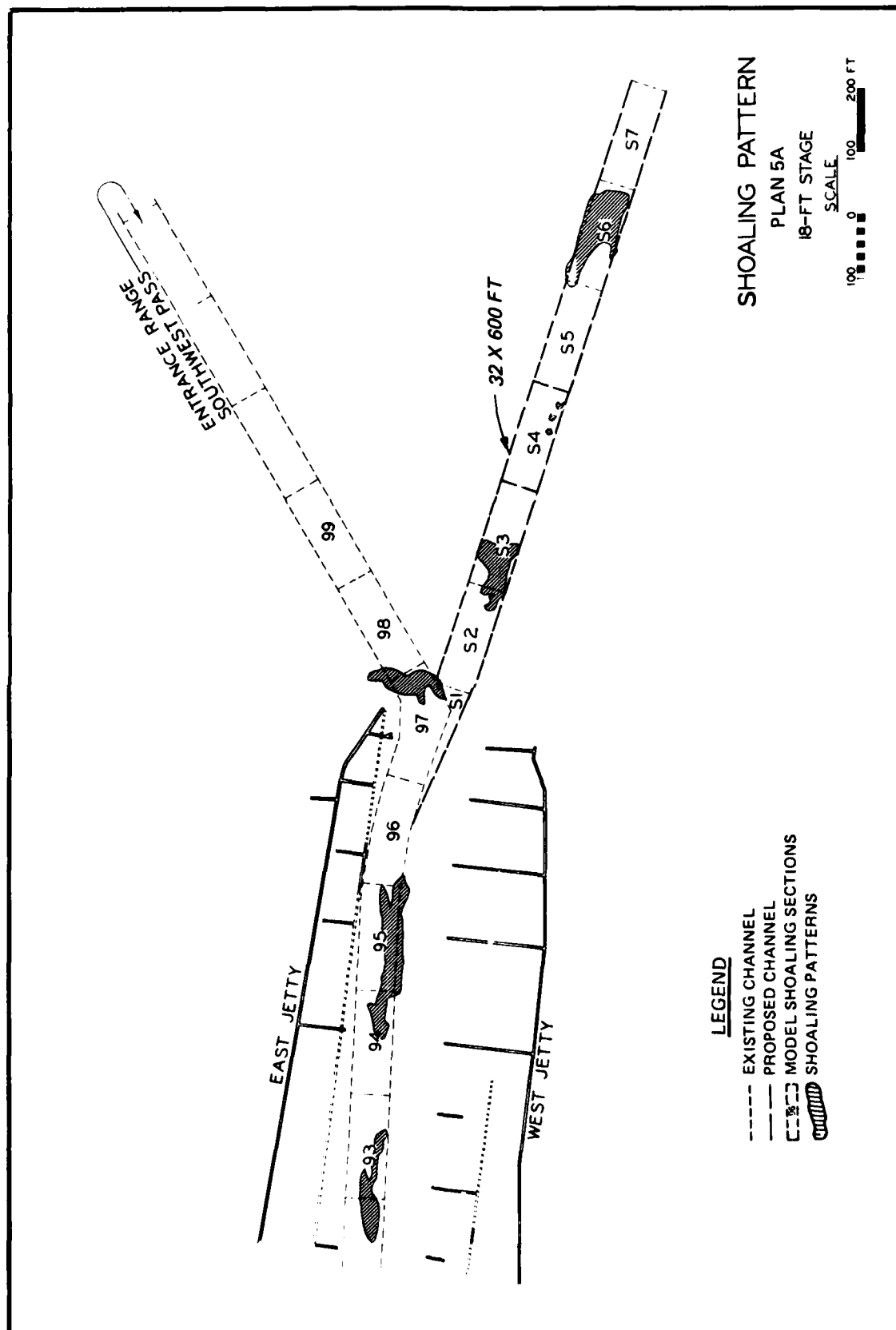
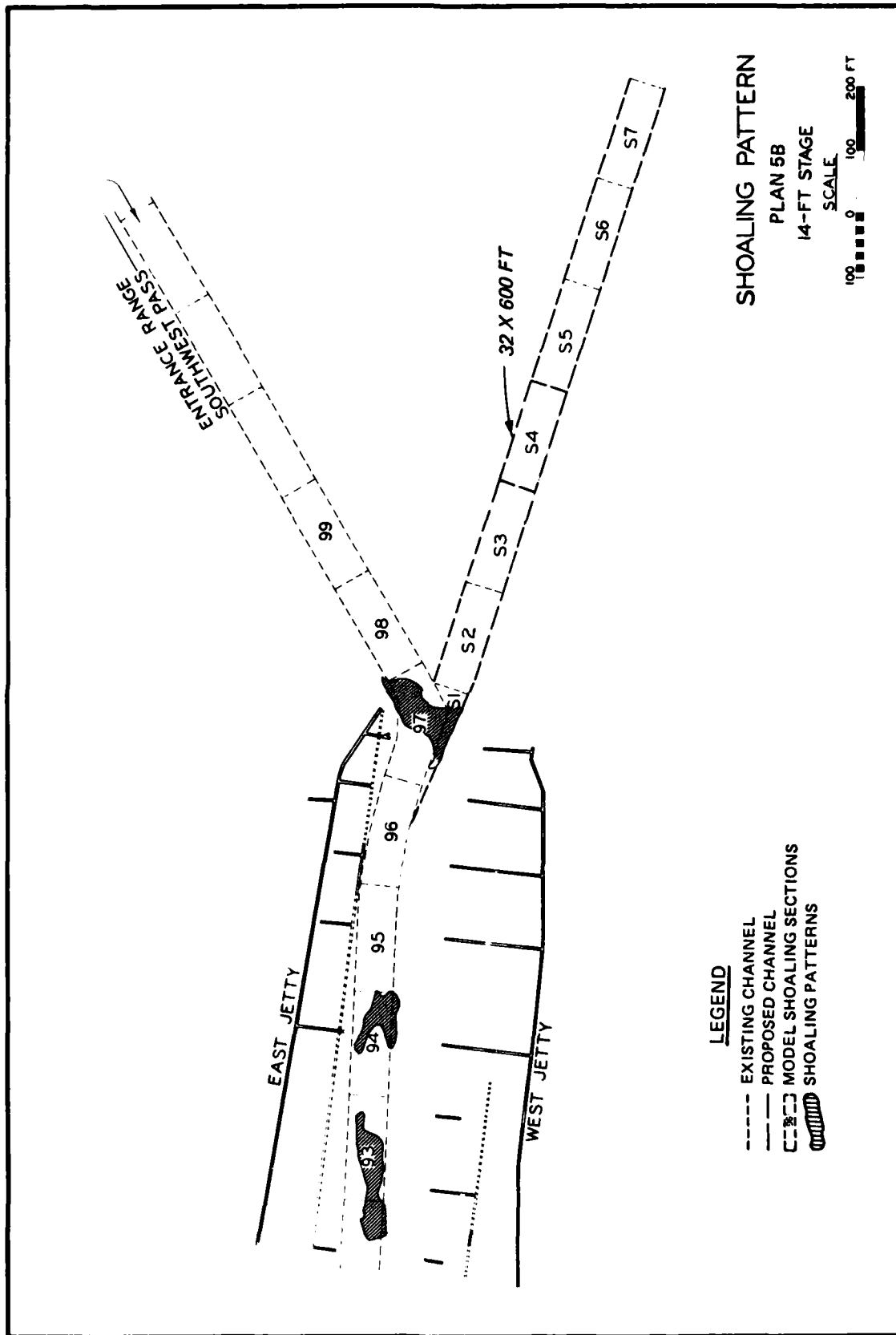


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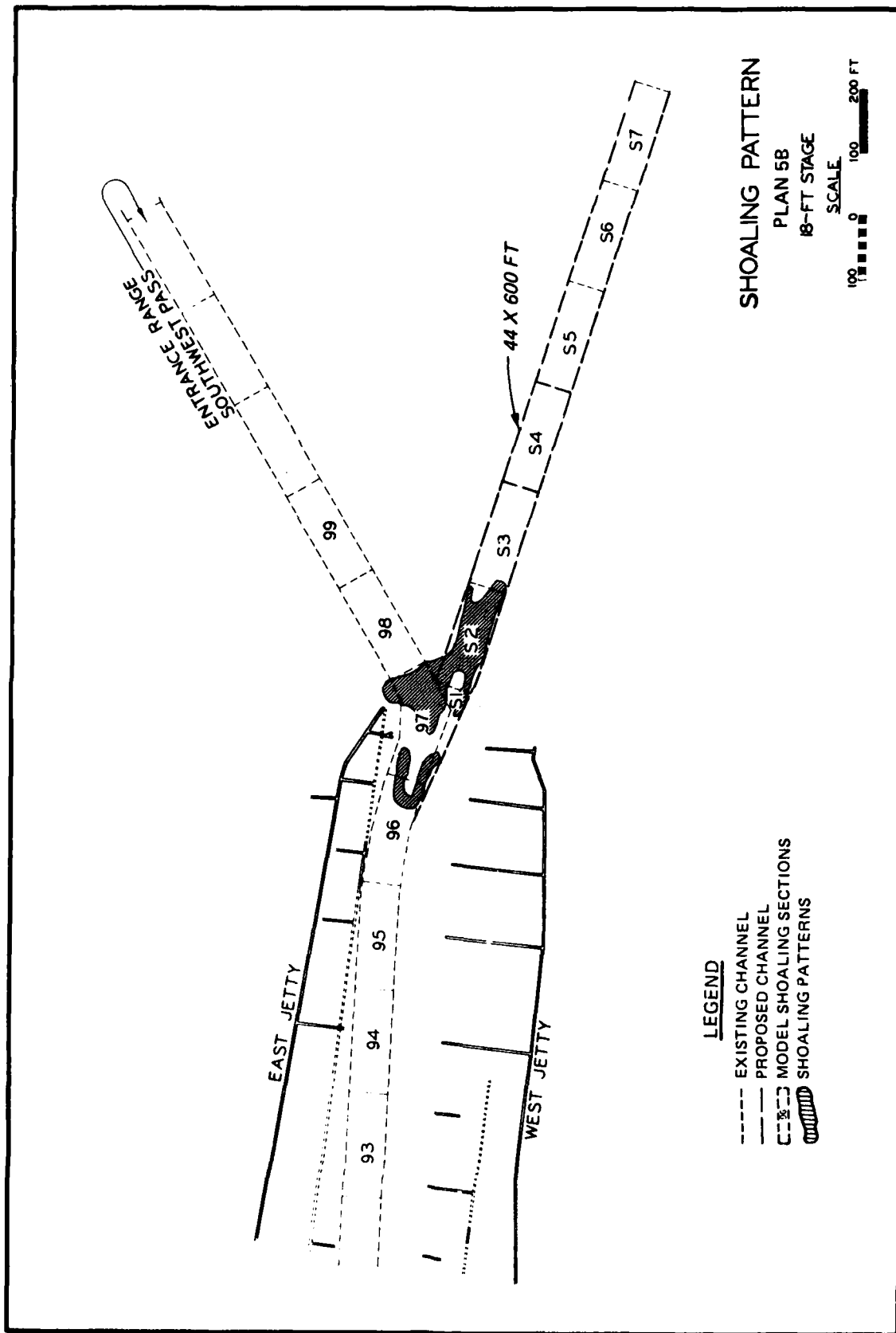


PLATE 32

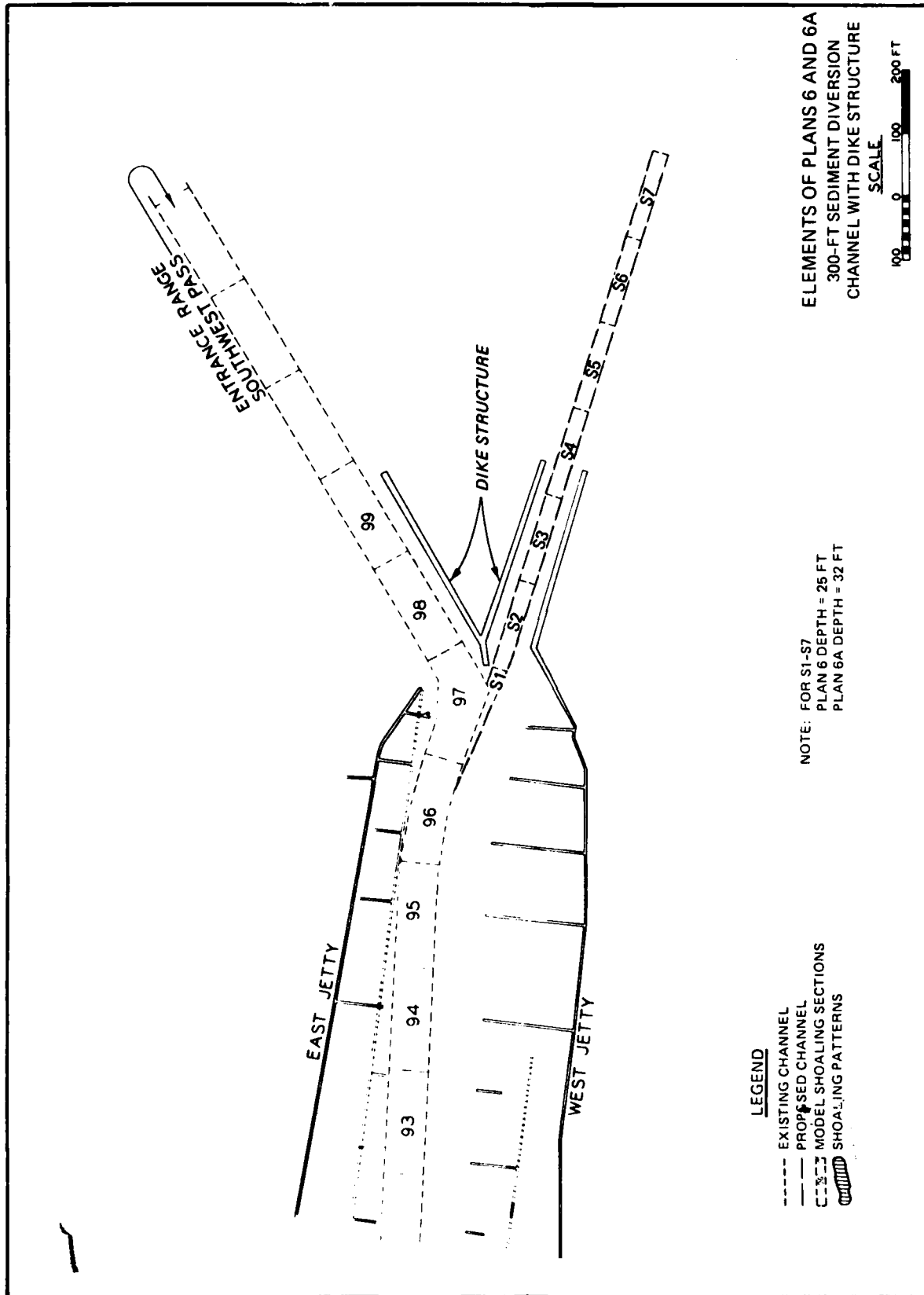
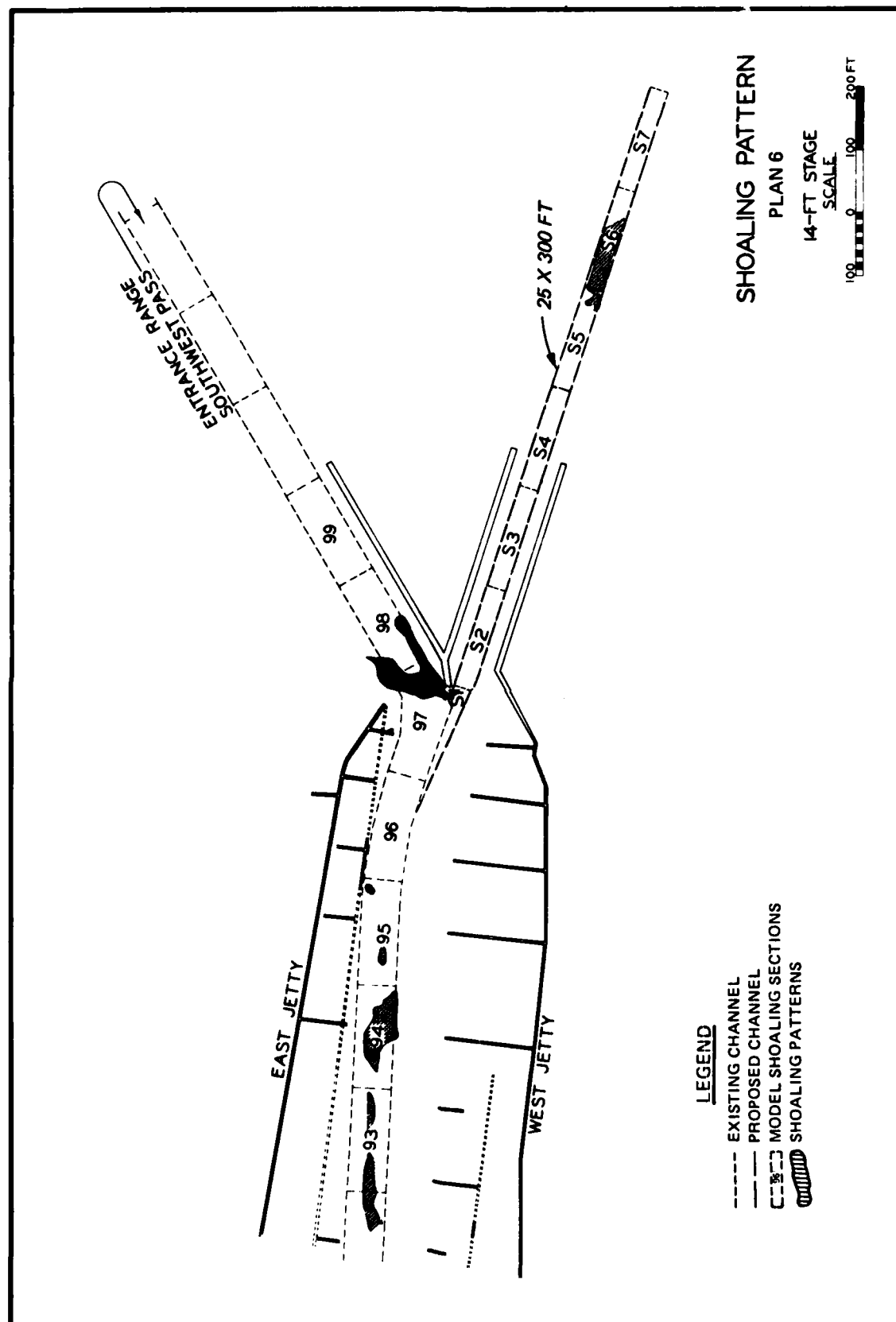
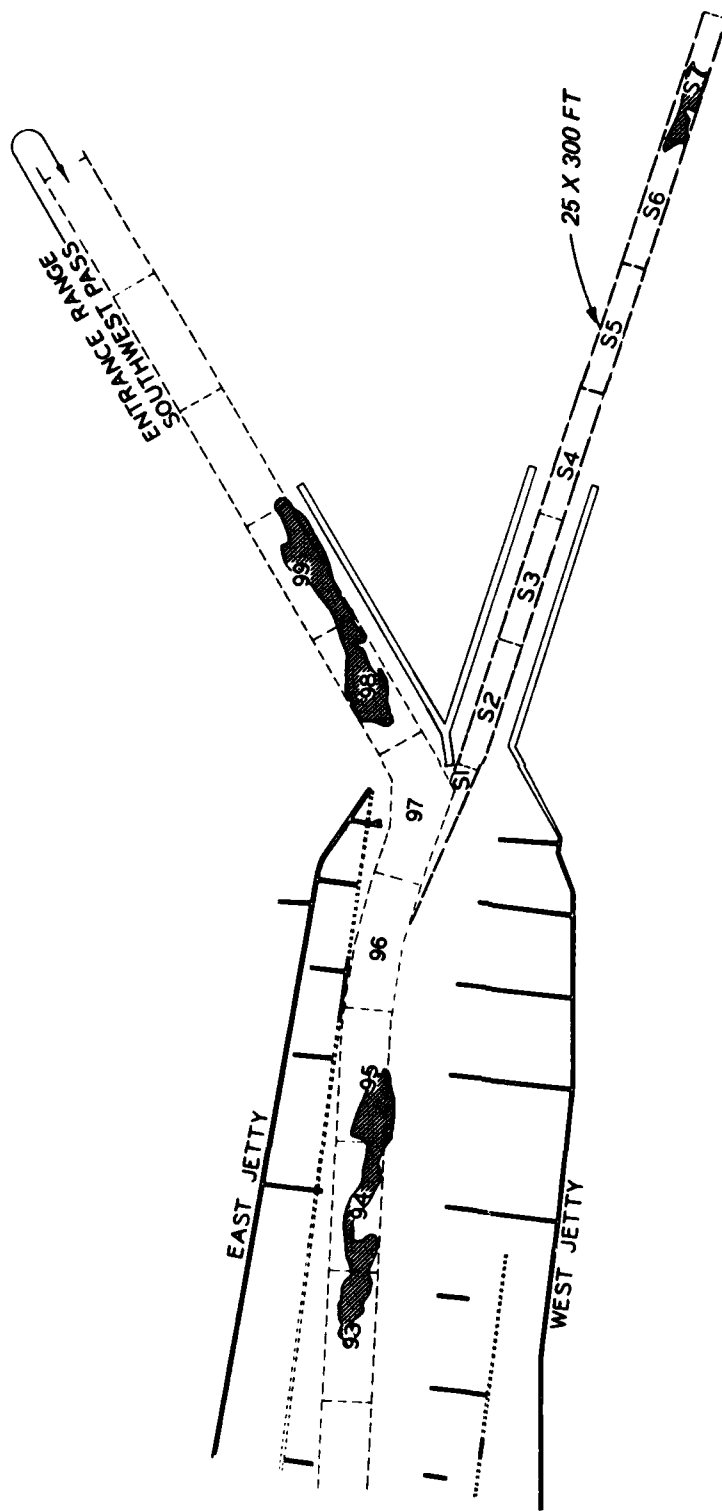


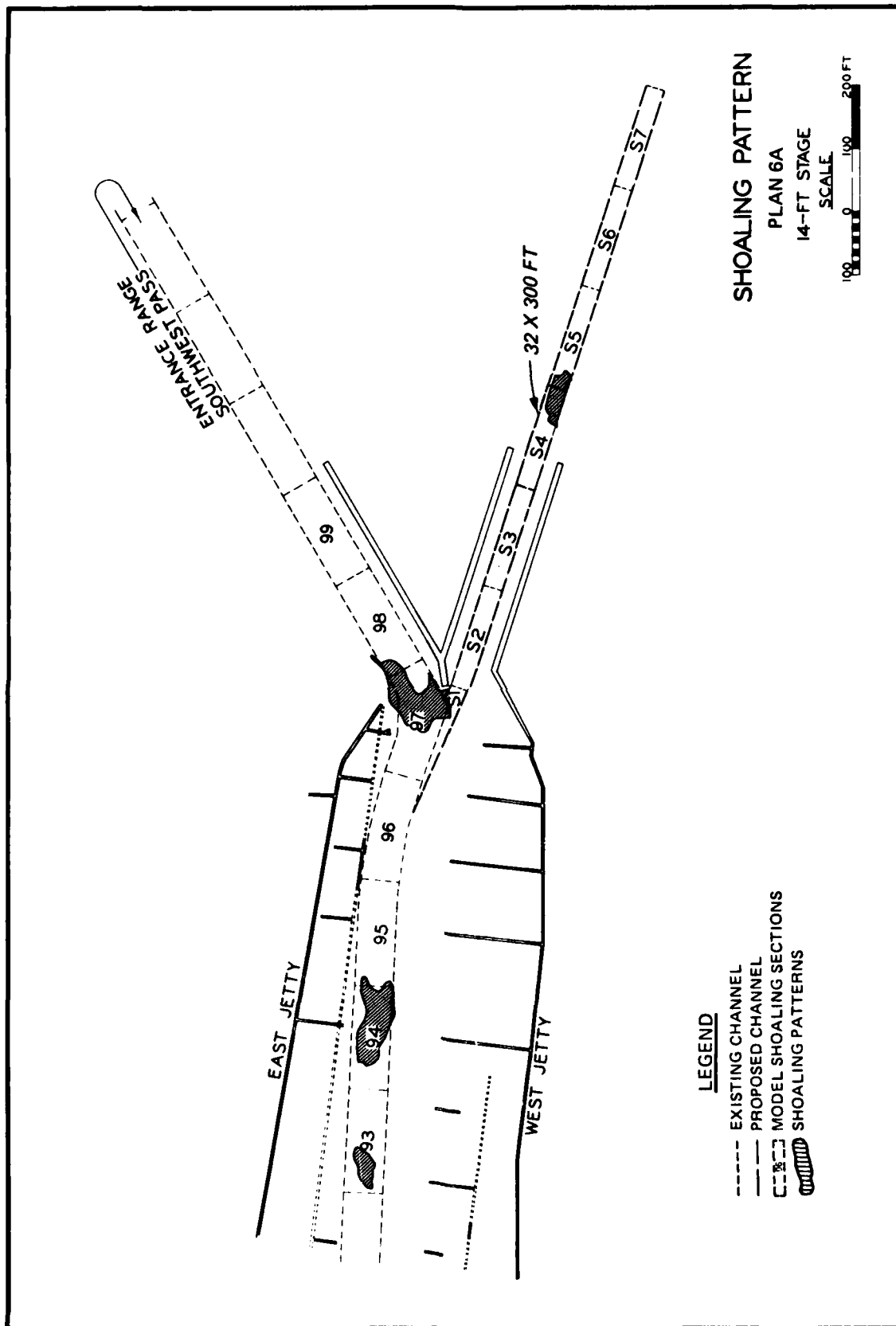
PLATE 33

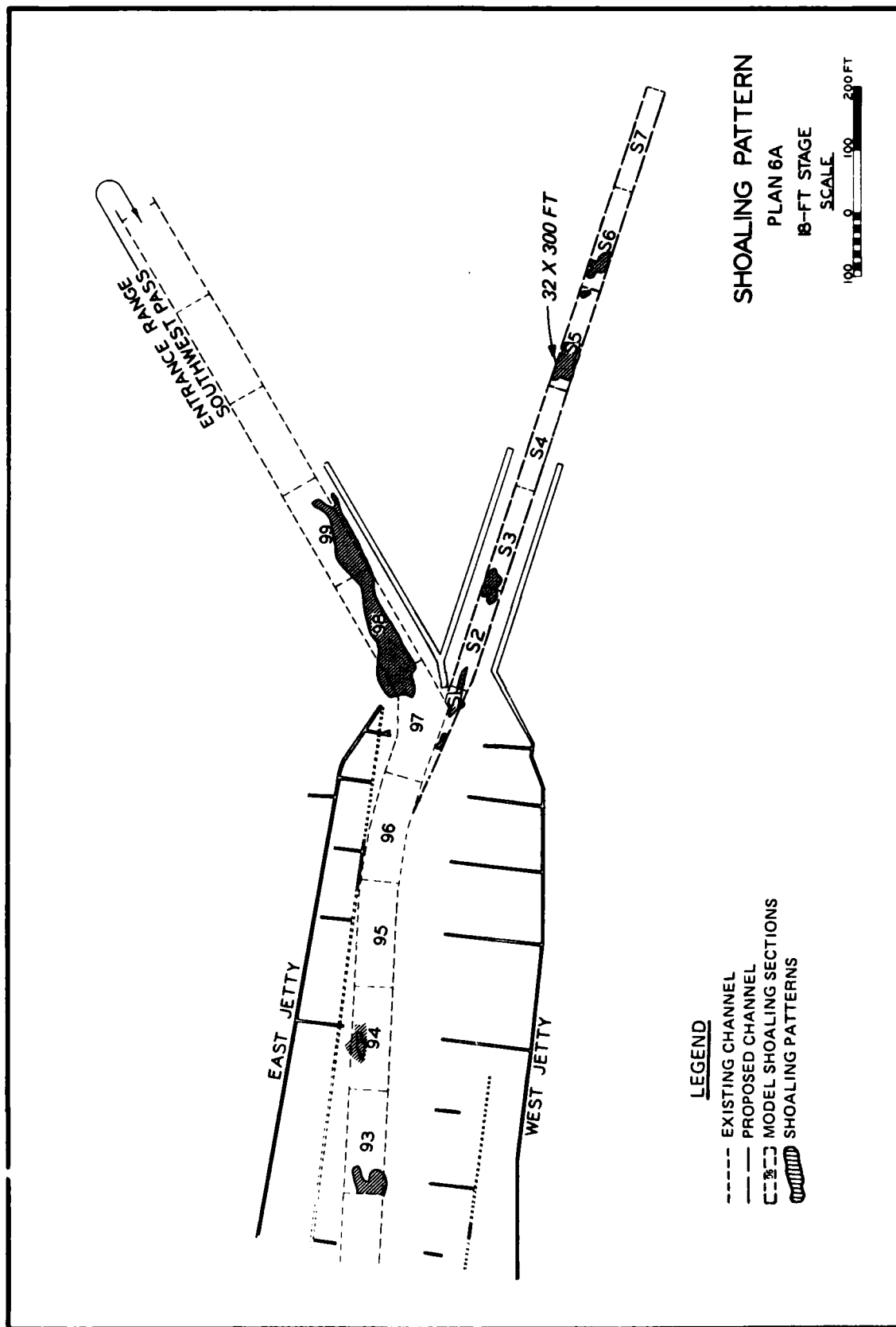


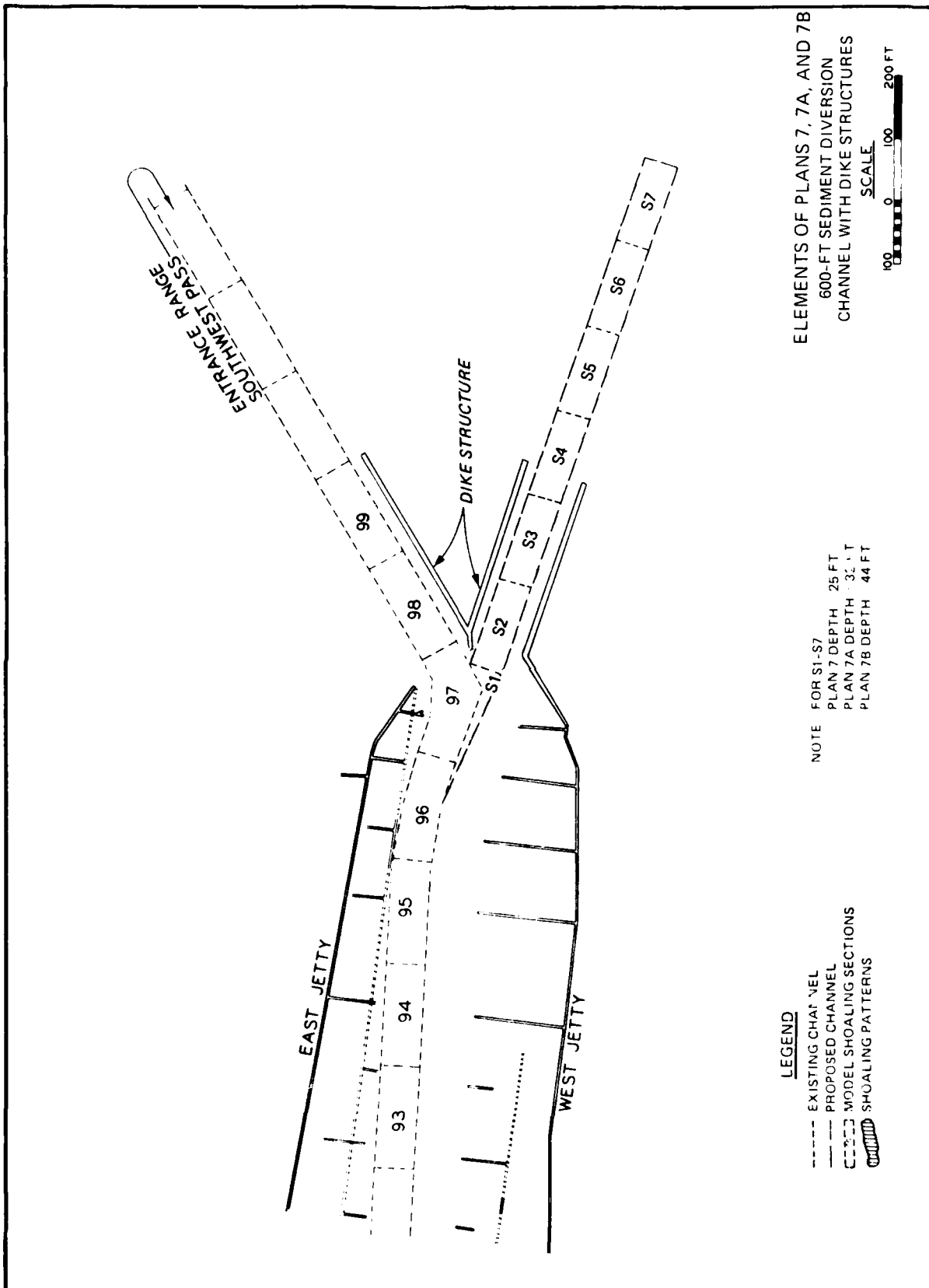


SHOALING PATTERN
PLAN 6
18-FT STAGE
SCALE

- LEGEND
- EXISTING CHANNEL
 - PROPOSED CHANNEL
 - - - - - MODEL SHOALING SECTIONS
 - ~~~~~ SHOALING PATTERNS







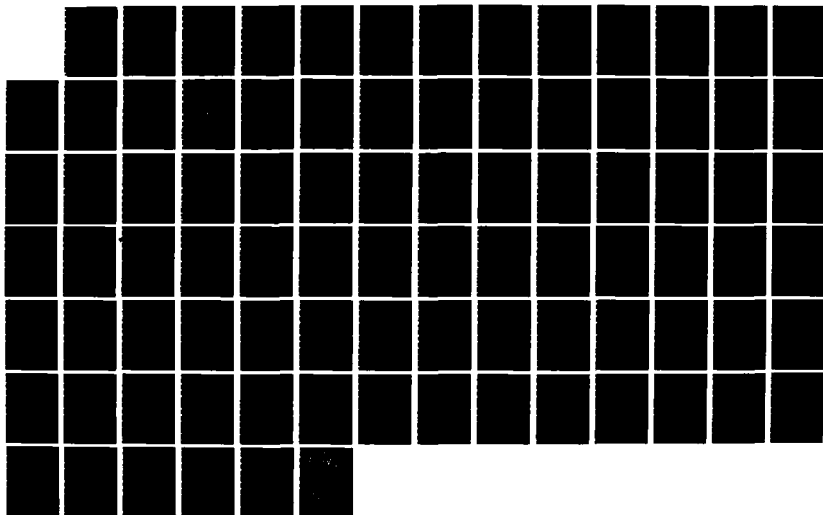
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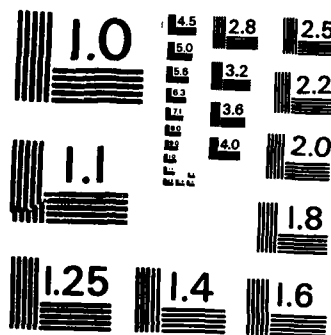
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SHOALING AND HYDRA (U) ARMY ENGINEER WATERWAYS
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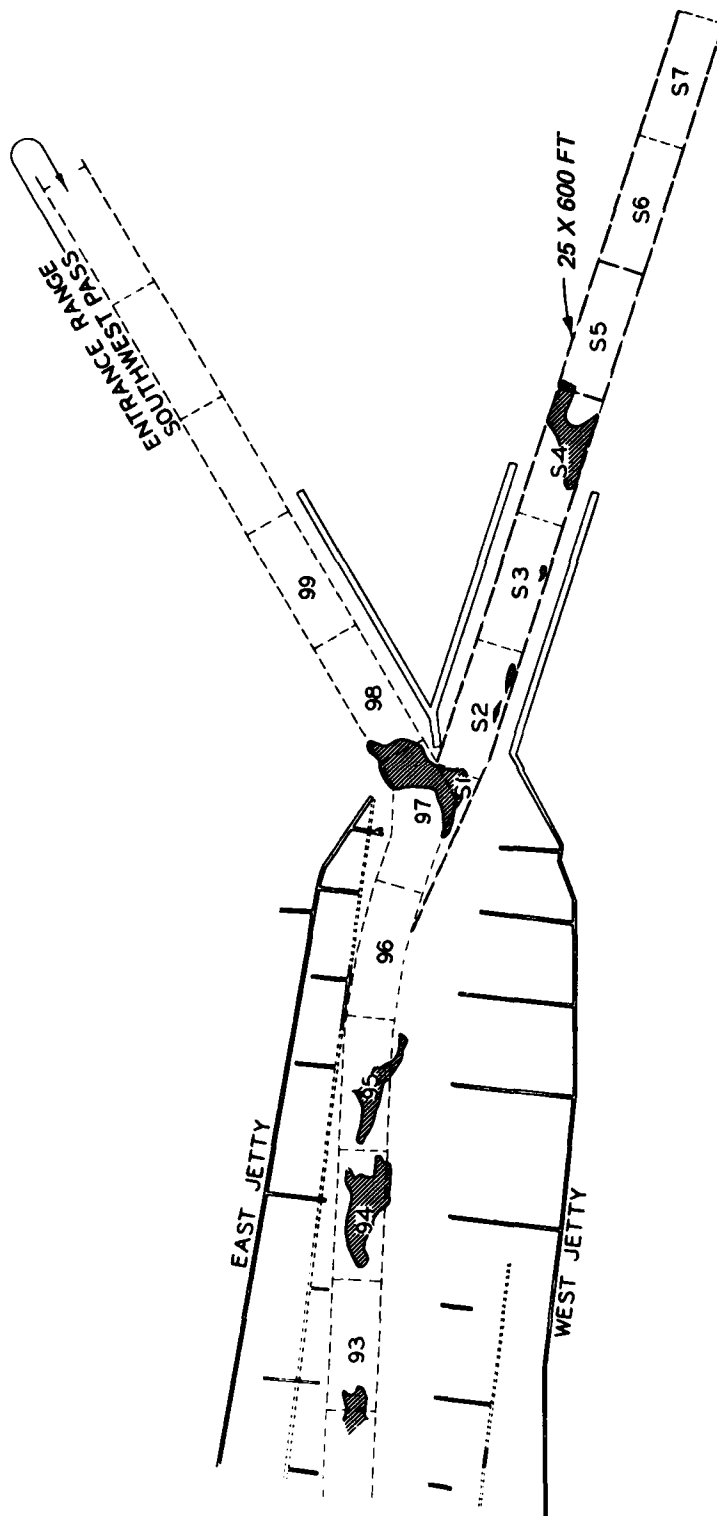
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A



SHOALING PATTERN

PLAN 7

14-FT STAGE

SCALE



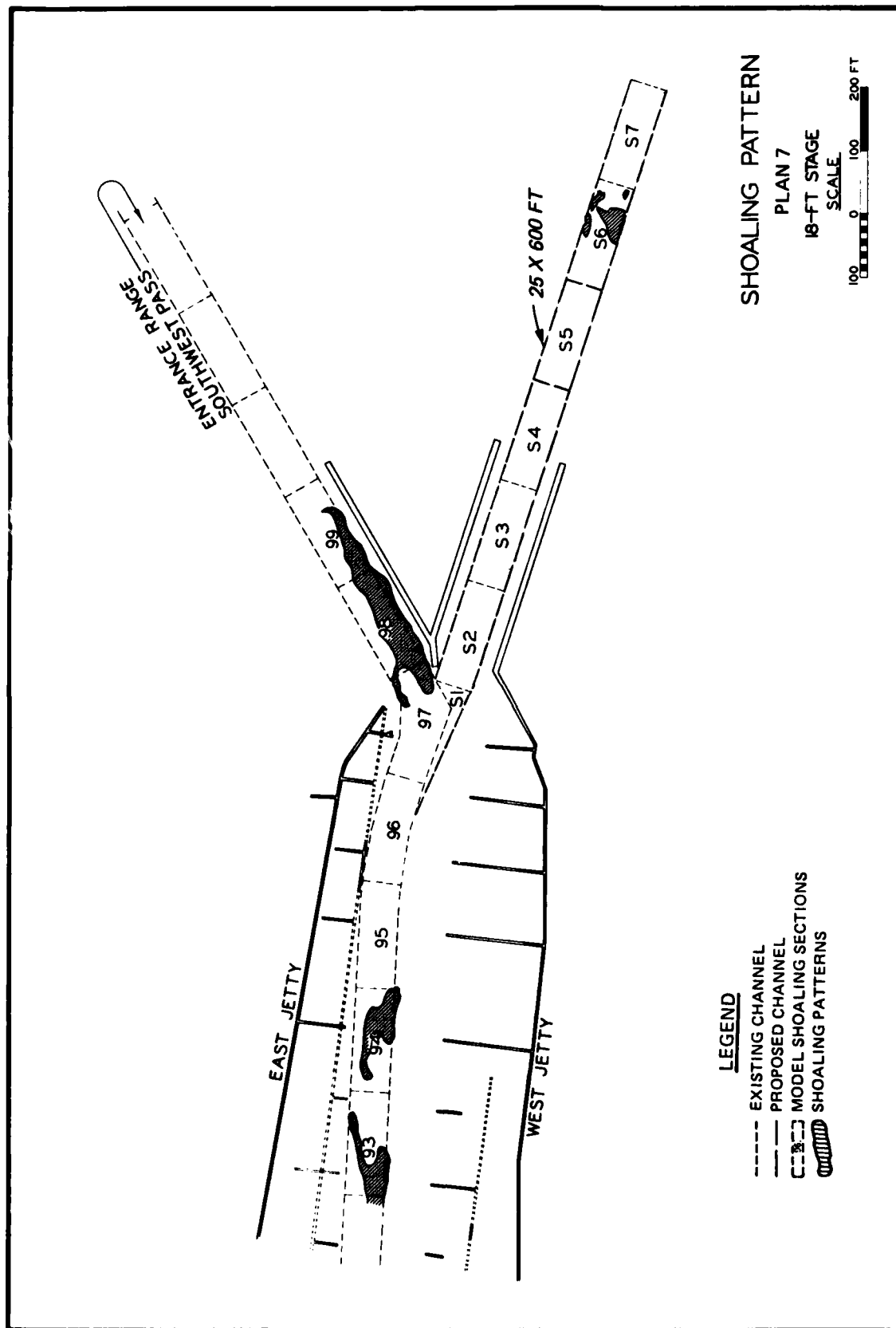
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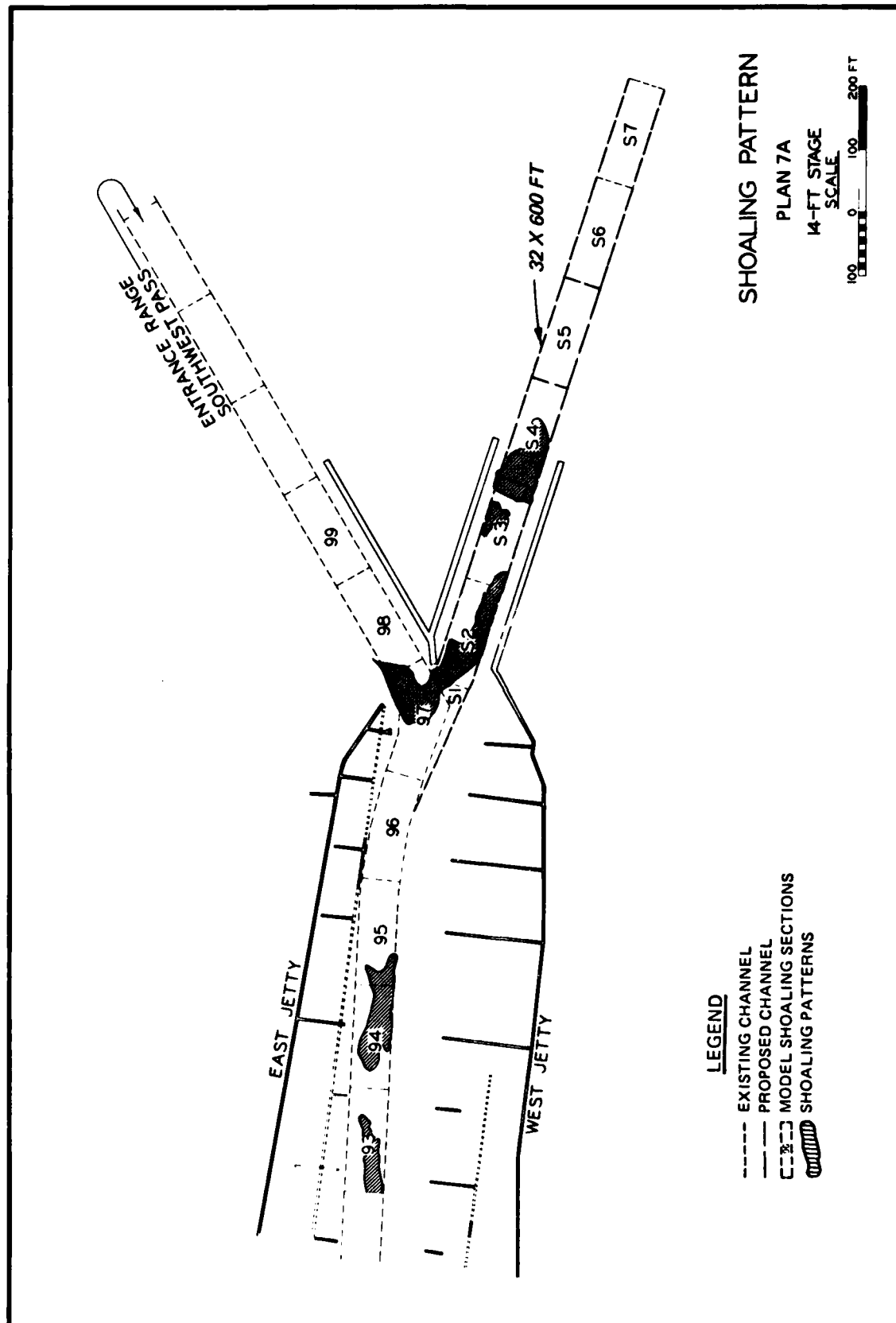
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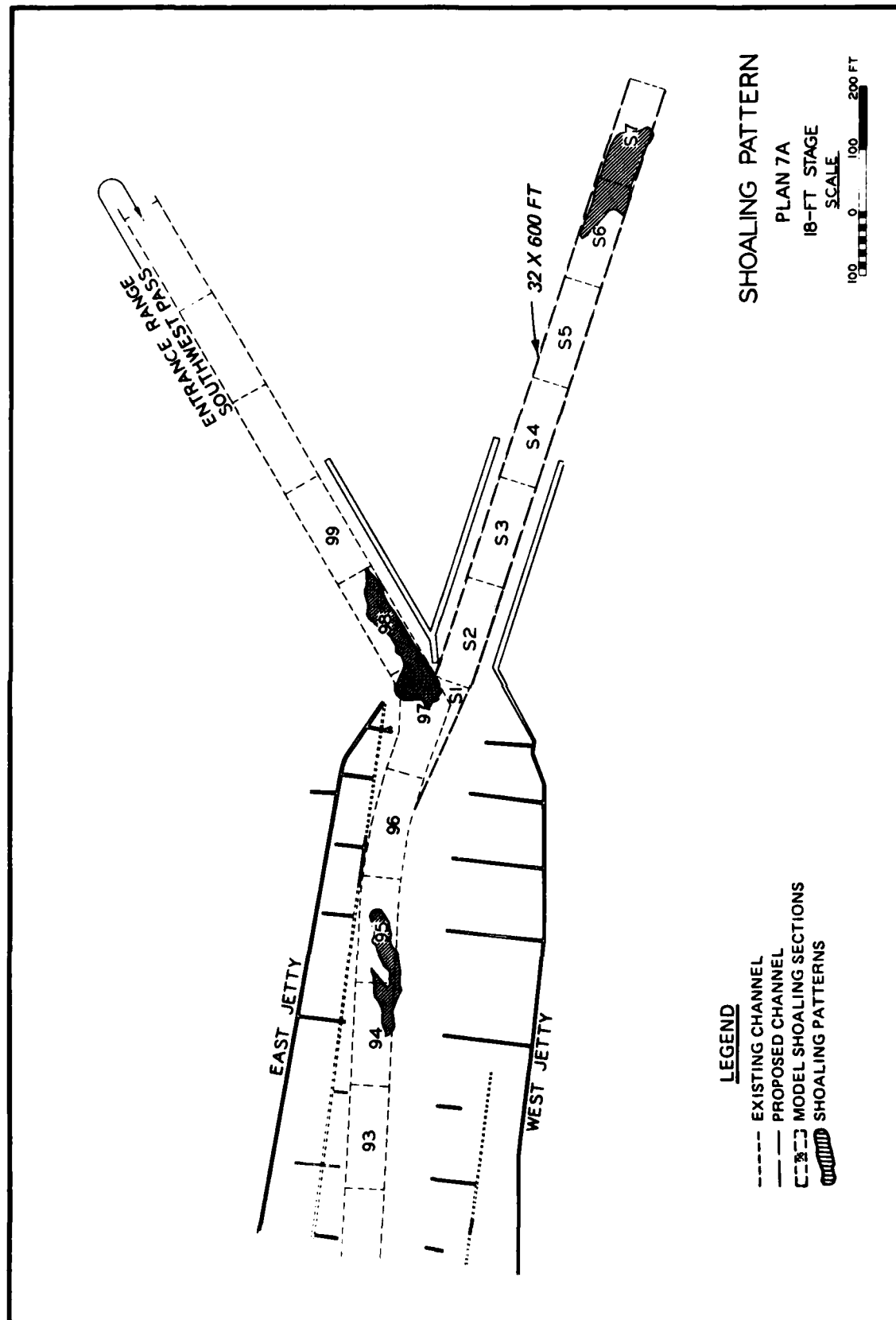
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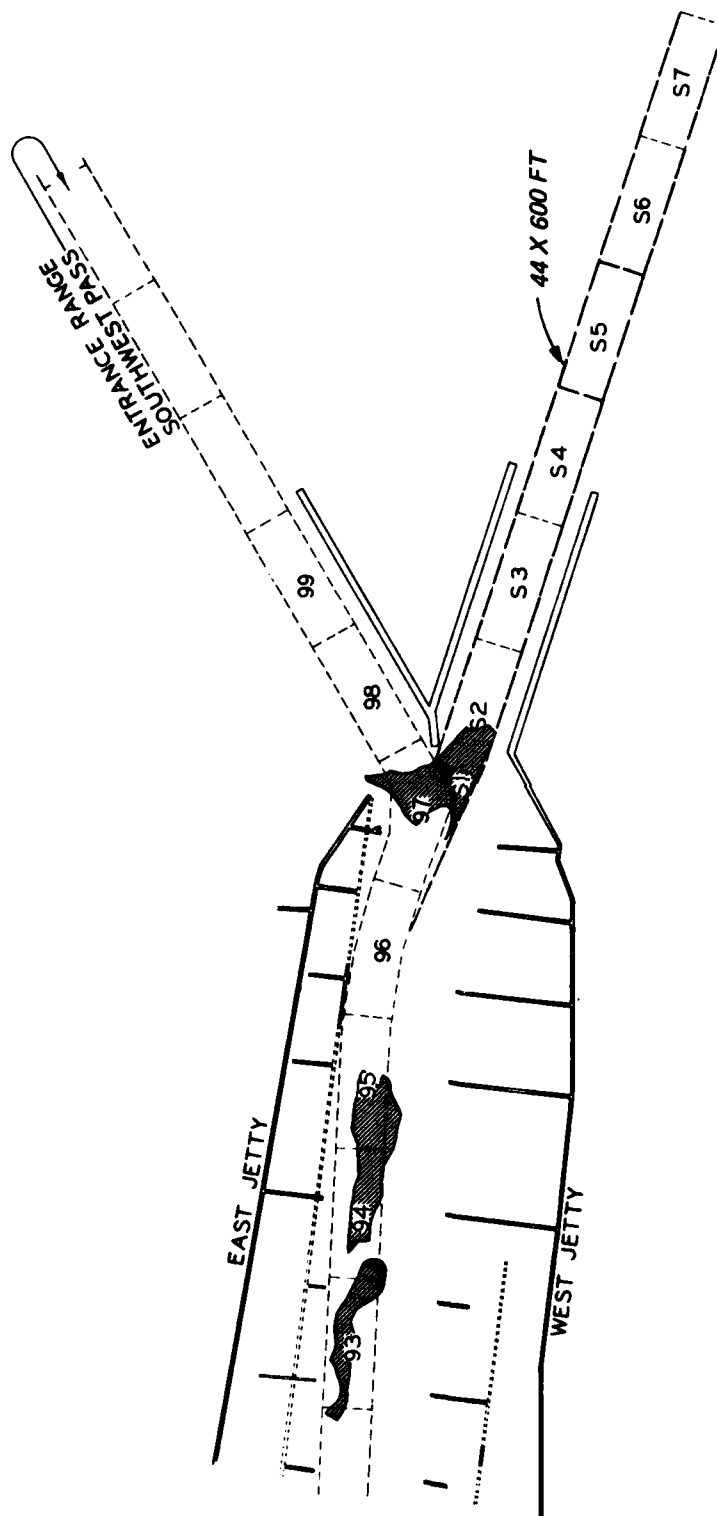
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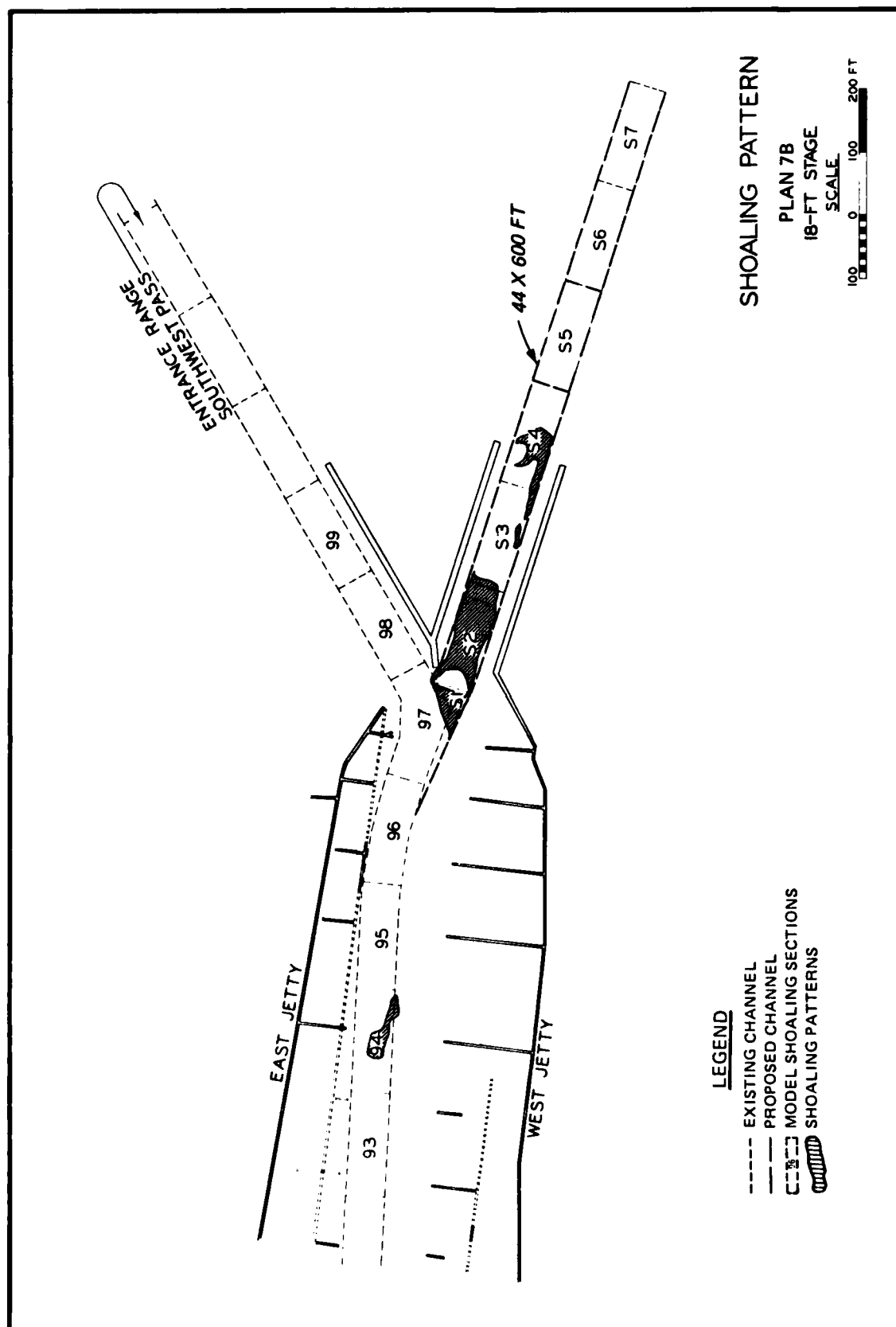
--- SHOALING PATTERNS

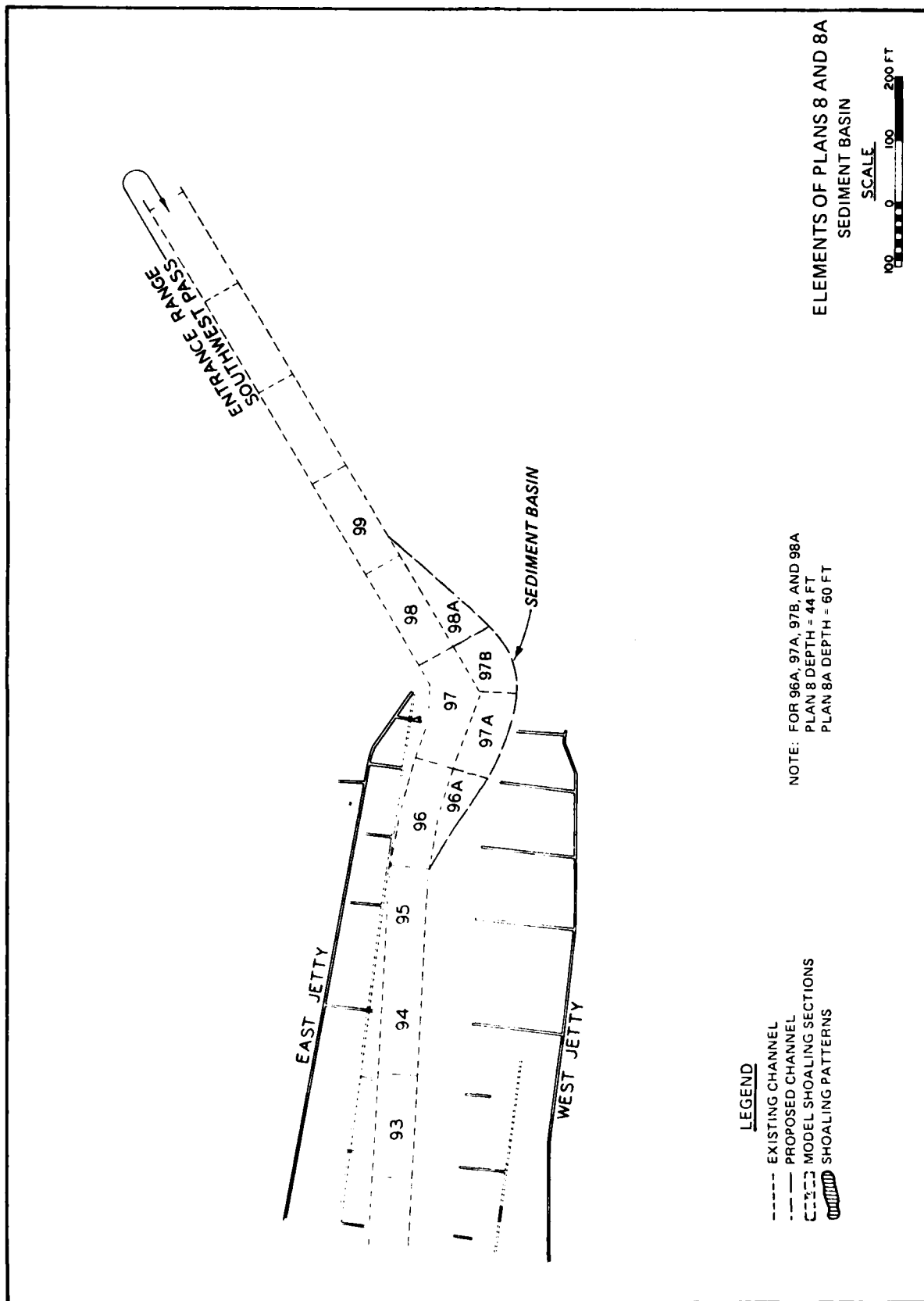


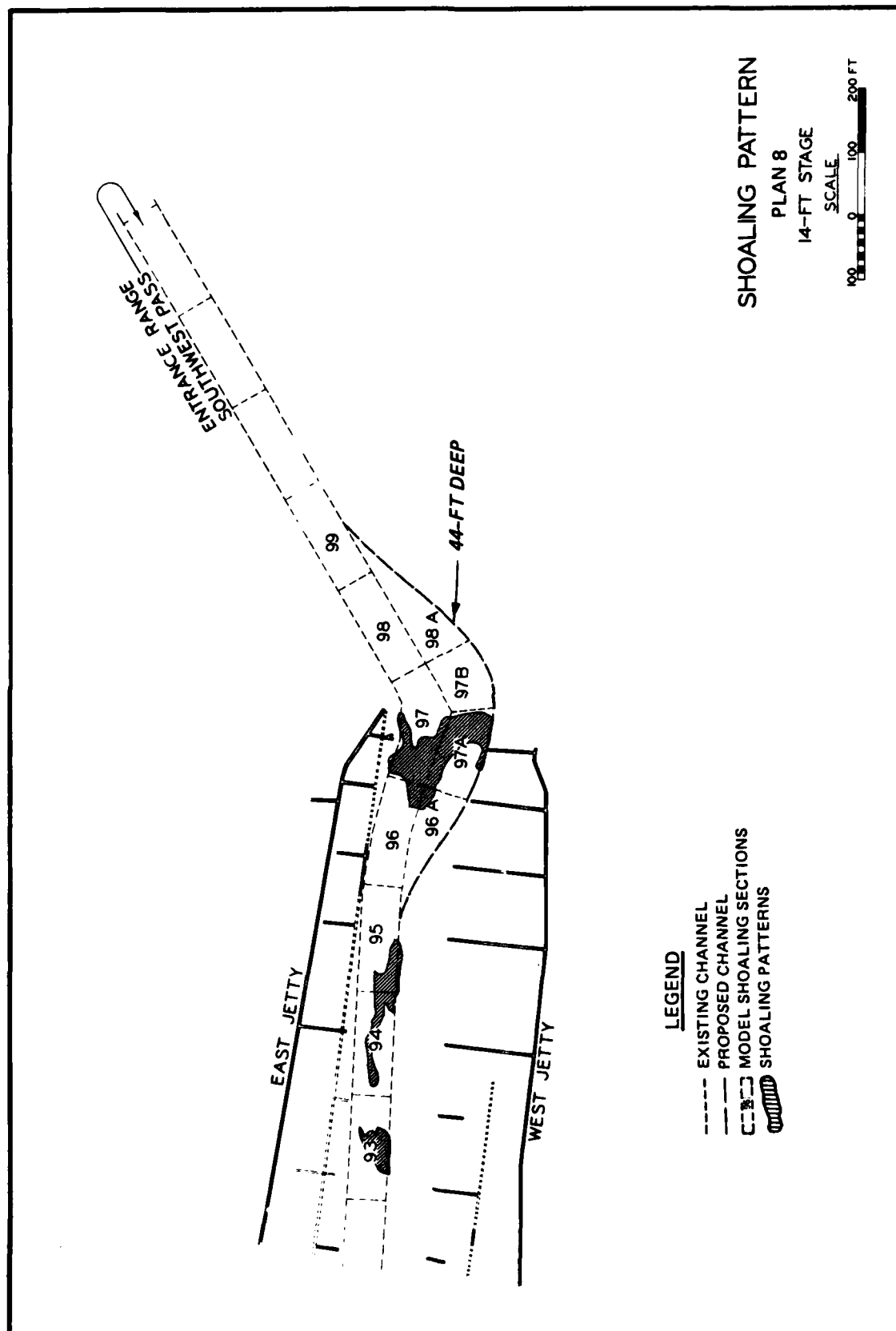












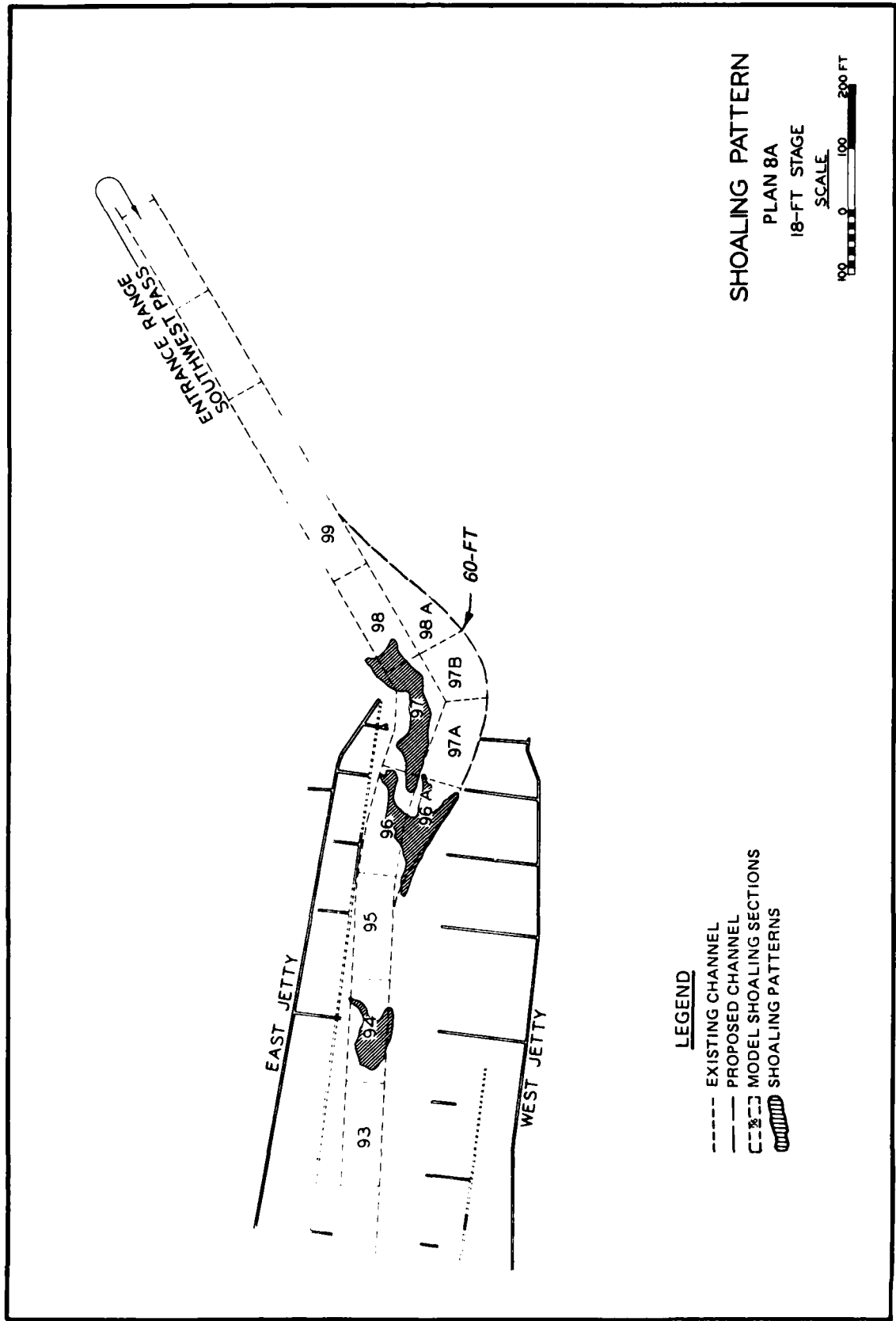
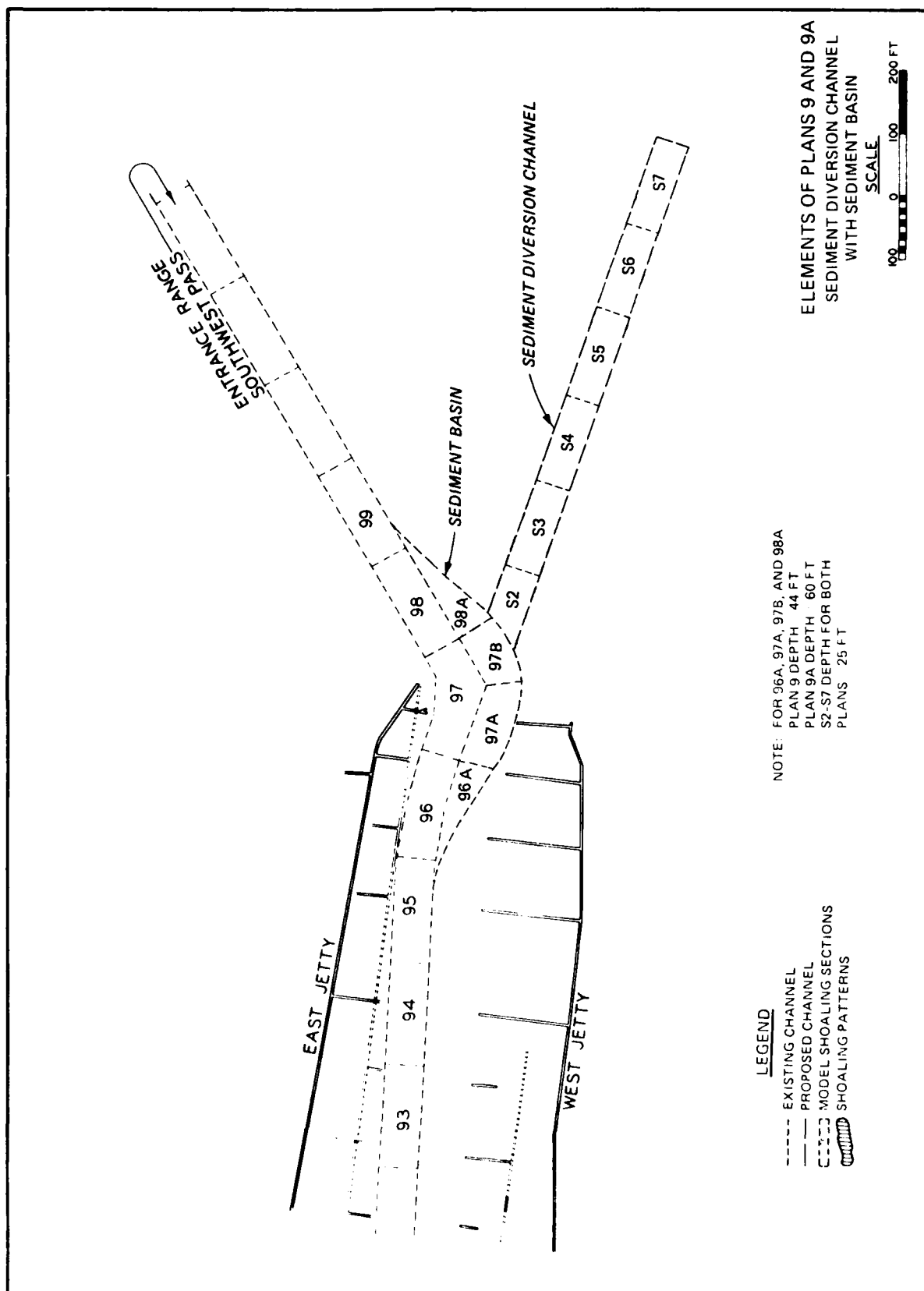
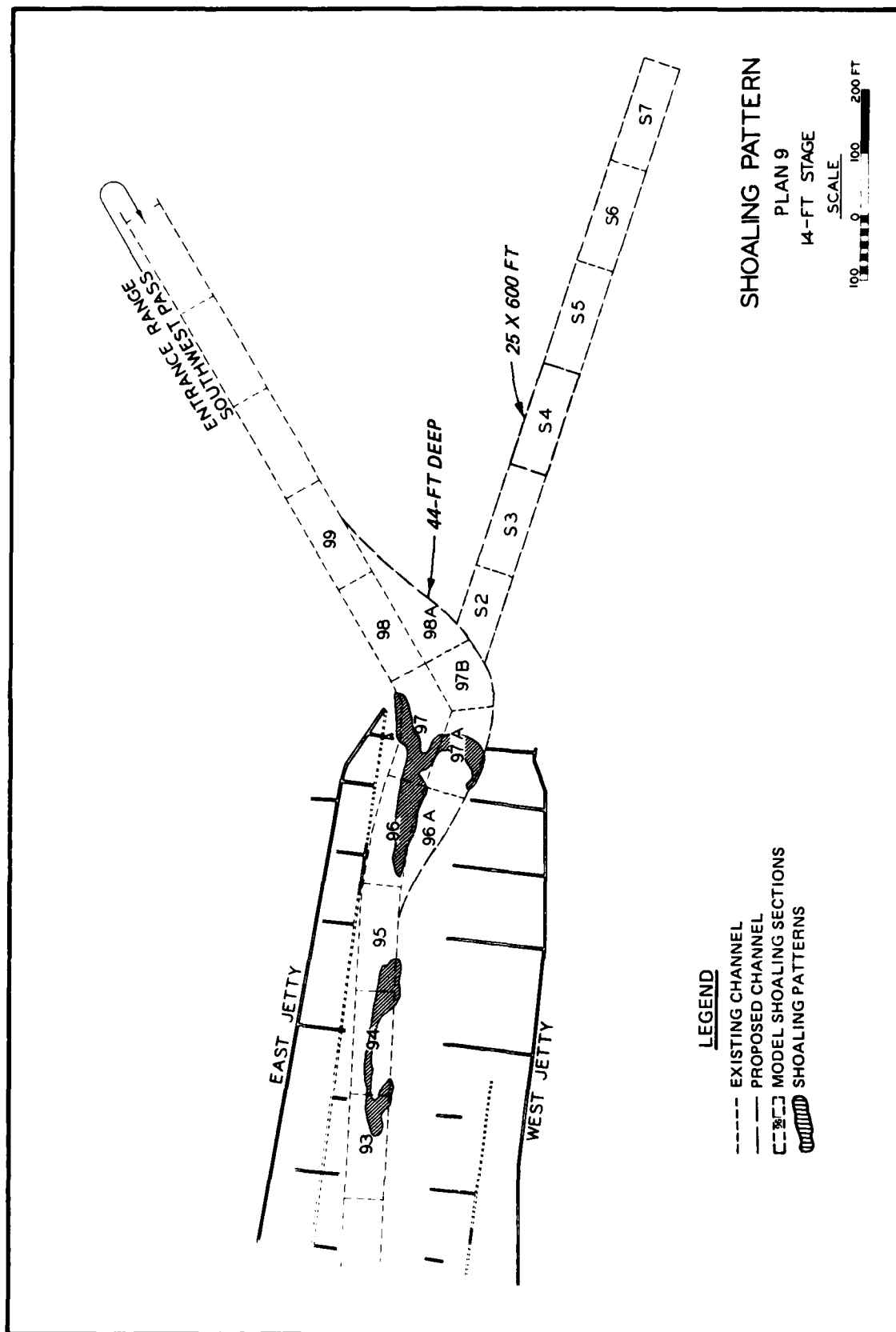
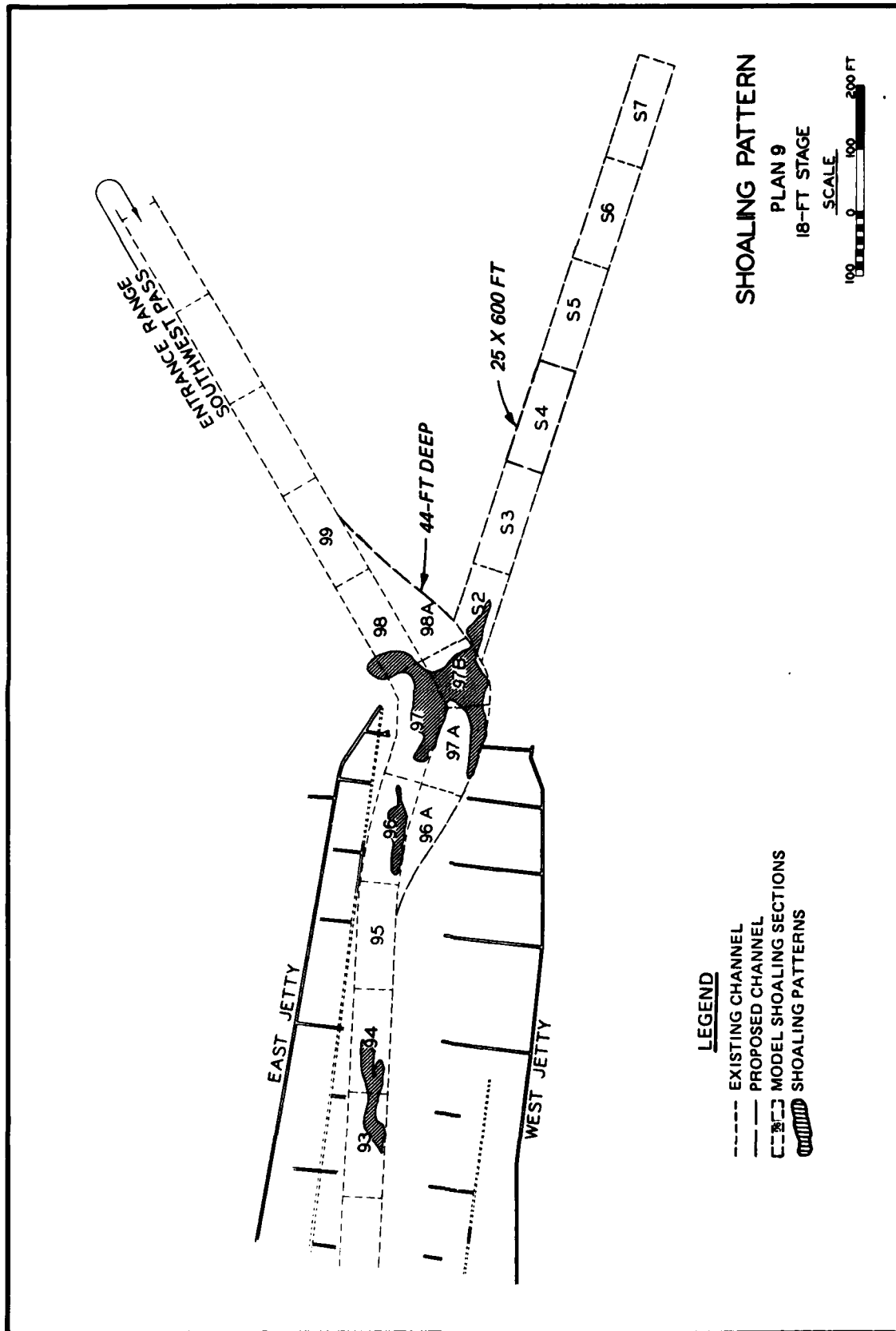
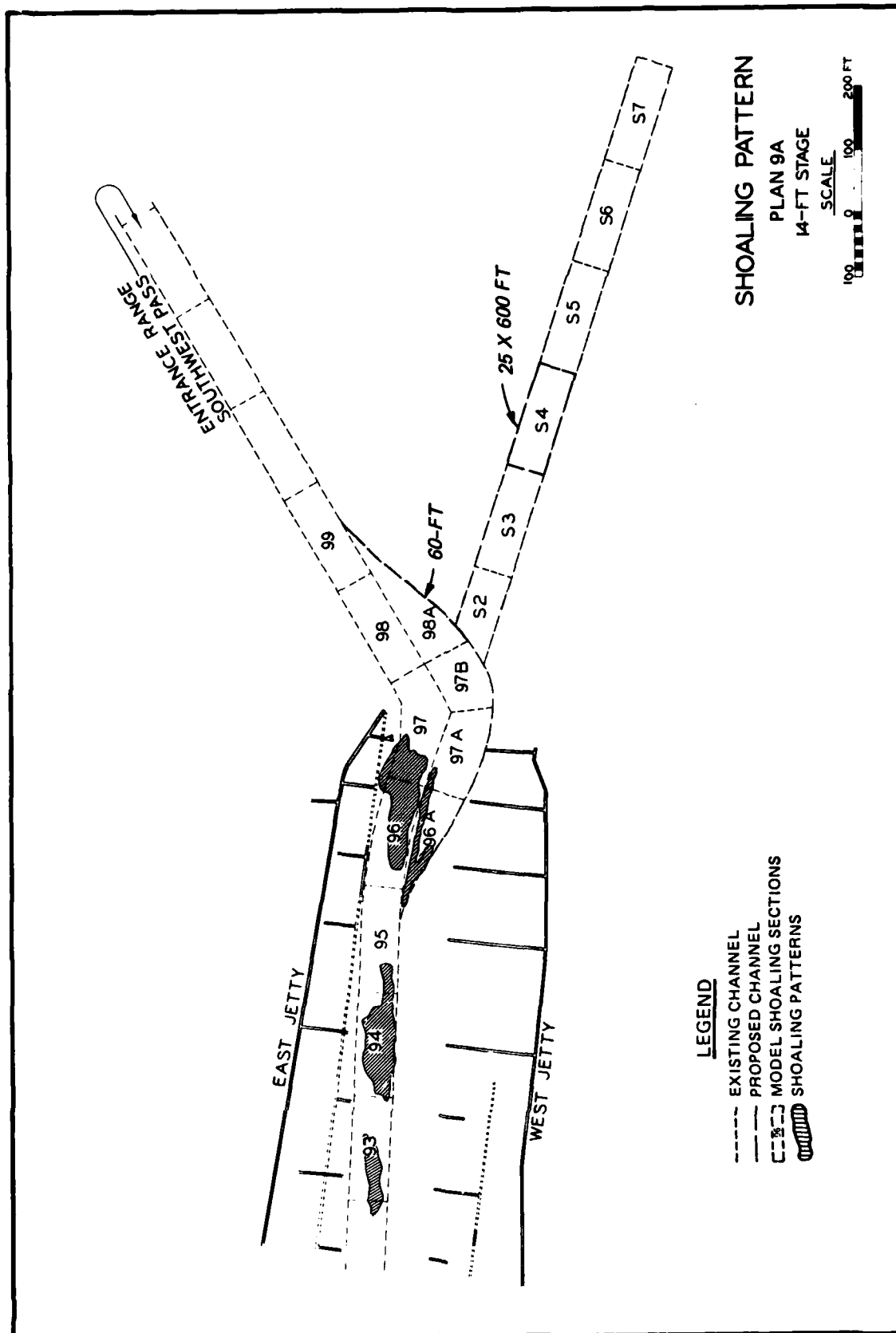


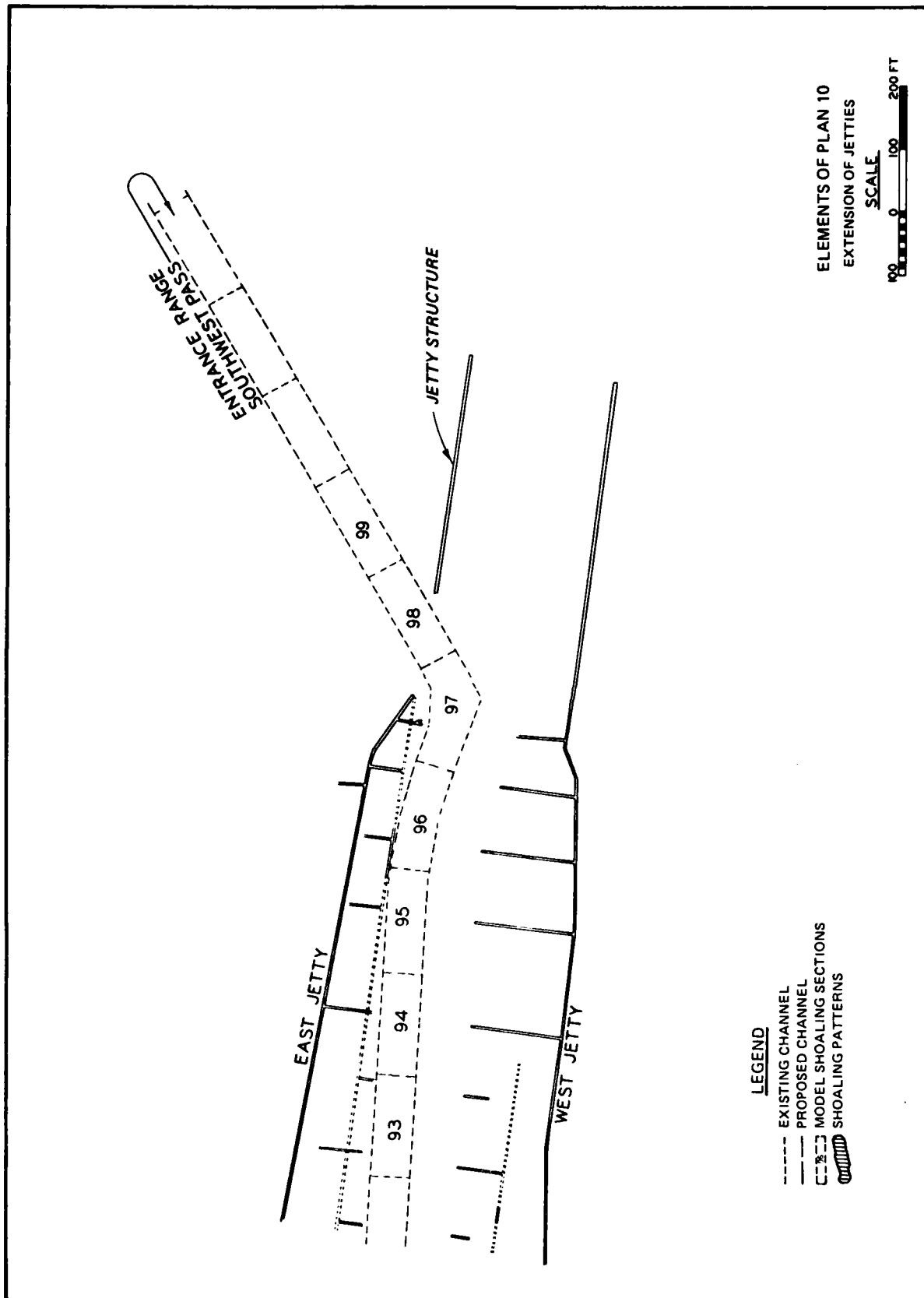
PLATE 48











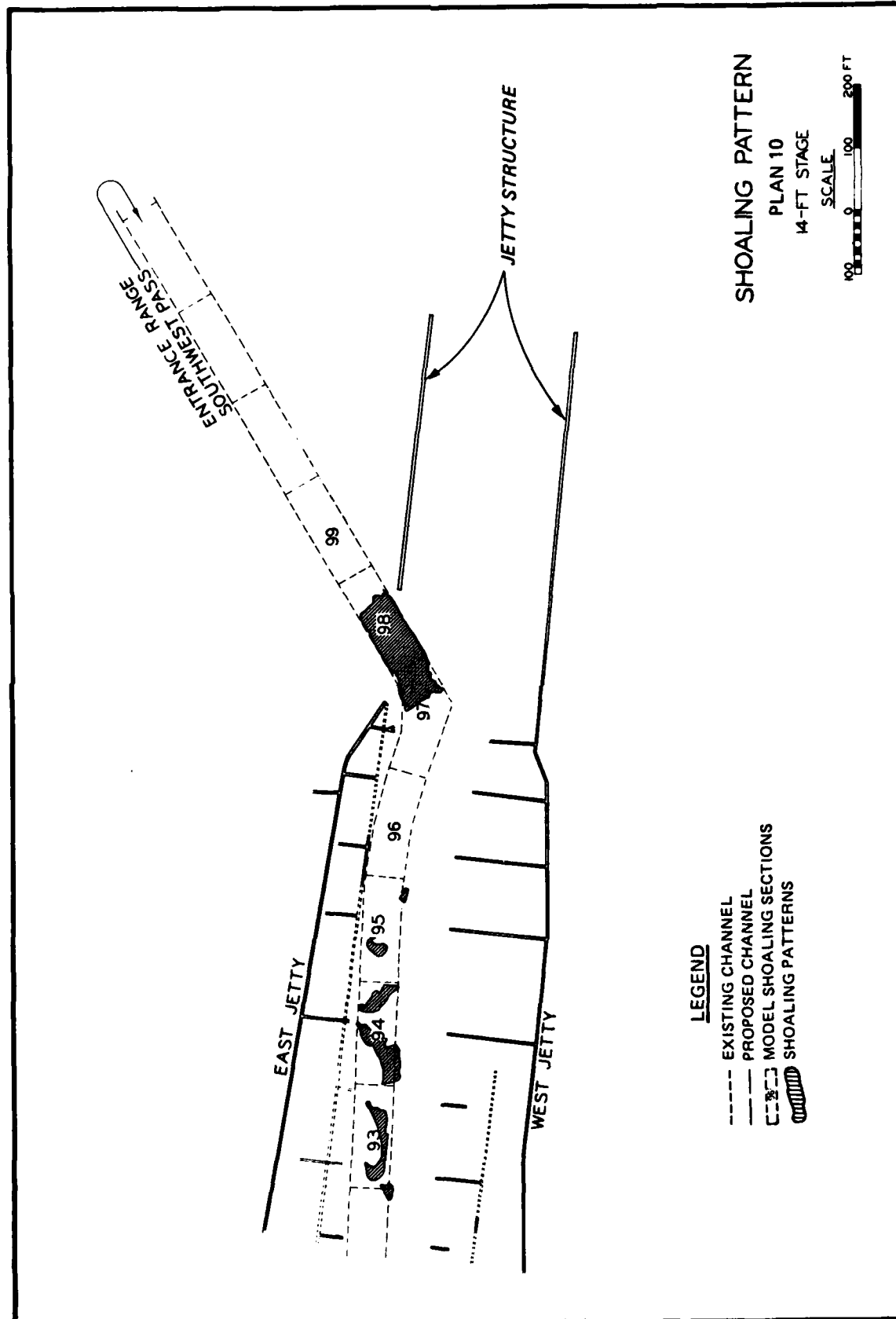
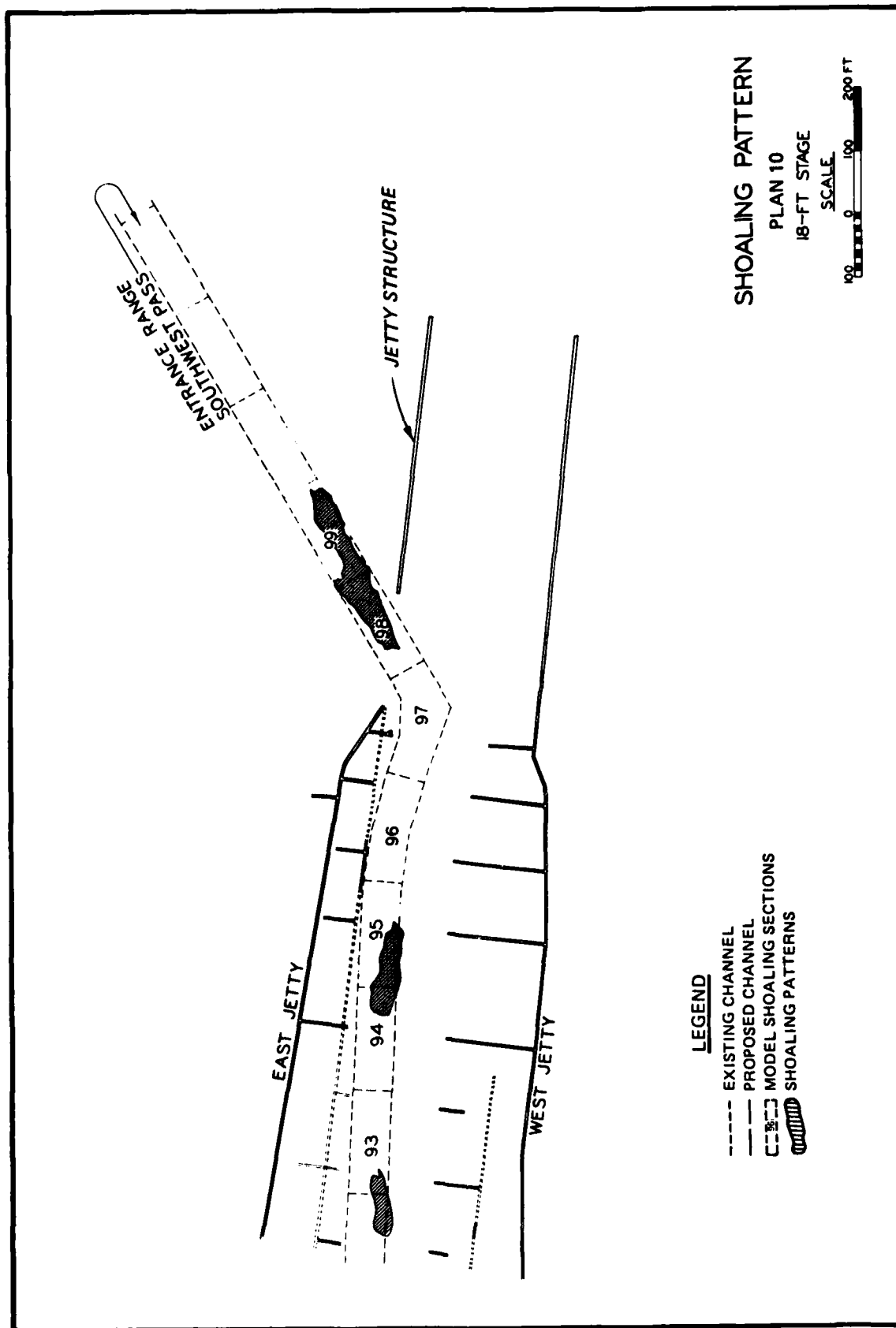


PLATE 54



APPENDIX A: SPUR DIKES AND FRICTION CHAMBERS, SOUTHWEST PASS

PART I: INTRODUCTION

Background

1. Maintenance of Southwest Pass (Plate A1), one of the three major outlets of the Mississippi River, is a continuing and expensive problem due to extensive shoaling, primarily near the ends of the jetties and to some extent throughout the entire length of the pass. Most of the shoaling in the jetty channel occurs during times of high freshwater discharge. This appendix presents the results of the model study conducted to determine the effectiveness of proposed plans (e.g., lateral dikes, extension of existing lateral dikes, and friction chambers) for the elimination or reduction of maintenance dredging in Southwest Pass and in the jetty and bar channels. Report 1 of this series presented the results of shoaling and hydraulic testing at Head of Passes (HOP). Results of shoaling tests in Southwest Pass for several proposed plans (e.g., lateral dikes, sediment diversion channel, a sediment basin, and relocation of the jetty channel) are presented in the main text. A similar study was conducted during the period January 1957-June 1959.* Descriptions of the model and prototype are given in PARTS II and III of the main text.

Purpose

2. The primary purposes of this study were to develop and evaluate plans for reducing channel shoaling in Southwest Pass of the Mississippi River by restricting the channel through the addition of structures.

Scope

3. This appendix contains the results of tests to reduce channel

* H. B. Simmons and H. J. Rhodes. 1965 (Aug). "Plans for Reducing Shoaling, Southwest Pass, Mississippi River; Hydraulic Model Investigation," Technical Report No. 2-690, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

shoaling from mile 8.4 BHP (below Head of Passes) to the Gulf of Mexico by the addition of lateral spur dikes and friction chambers throughout Southwest Pass, and also to determine the effects of constricting the effective channel width from 1,450 to 1,200 and 1,000 ft.

PART II: TESTING PROGRAM

Plan Tests

4. Six plans (addition and extension of structures in Southwest Pass) proposed for reduction of shoaling between miles 10 and 15 and in the entrance channel of Southwest Pass are reported herein. The first plan (BA) tested involved the addition of 13 lateral spur dikes and 4 friction chambers (a constriction area between two dikes made by constructing a dike from end to end parallel to the channel) between miles 1 and 5 in Southwest Pass. The second plan (BB) tested added two lateral spur dikes and three friction chambers between miles 5 and 9 in Southwest Pass including the additions in Plan BA. The third plan (BC) tested added 17 lateral spur dikes and 6 friction chambers between miles 9 and 12.5 in Southwest Pass plus the dikes and friction chambers of Plans BA and BB. The fourth plan (BD) tested involved the addition of 17 lateral spur dikes and 8 friction chambers between miles 12.5 and 17 in Southwest Pass plus the dikes and friction chambers of Plans BA, BB, and BC. The fifth plan (BE) tested involved reducing the effective channel width (end-of-dike to end-of-dike) from 1,420 to 1,200 ft by extending the lengths of the dikes for all previous plan dike additions plus existing dikes. The last plan (BF) tested was similar to Plan BE, but the effective channel width was reduced from 1,200 to 1,000 ft.

Test Procedures

5. Model test conditions for base and plan tests consisted of reproduction of freshwater discharges of 640,000, 900,000, and 1,300,000 cfs, which correspond to Carrollton gage stages of 10, 14, and 18 ft, respectively, and a tide with a 1.1-ft range in the Gulf. After three stabilization cycles had been completed, approximately 36,000 cc of shoaling material was equally distributed throughout the next six tidal cycles (Table A1) from mile 8.4 BHP or model section 50 (see Plate A3) to the limit of salinity intrusion in lower Southwest Pass. The upstream limit of salinity intrusion in Southwest Pass for the 10-, 14-, and 18-ft Carrollton stages is approximately miles 18.0, 19.5, and 20.0 BHP, respectively. The shoaling material used for this study was granular plastic of various specific gravities ranging from

1.05 to 1.20. After all the shoaling material had been introduced, one more tidal cycle was reproduced before the test was concluded. At the conclusion of each shoaling test, the material that deposited in each channel section was retrieved and measured. The same procedure for introducing shoaling material was followed for all tests and plans. Tidal heights and current velocities were taken at the locations shown in Plate A1. Existing dikes in Southwest Pass are shown in Plates A2 and A3. Results of these tests (Tables A2-A17) were compared with the results of similar tests of existing conditions (Plates A16, A17, and A18). Table A18 is a summary of the shoaling indices of the plan tests. The table is divided into two areas of shoaling and also shows the effect of the plan on the entire channel. Area 1 includes the channel area from mile 8.4 to 14.8, model channel sections 59-76. Area 2 includes the channel area from mile 14.8 to 20.4, model channel sections 77-98.

Presentation of Data

6. Shoaling patterns for all tests reported herein are shown in appropriate plates. Test results for all six plans are listed in Tables A2-A17 and summarized as shoaling indices in Table A18. A shoaling index is computed by dividing the plan shoaling volume for a channel section by the base test shoaling volume for the same channel section. Therefore, if the plan reduces shoaling, the shoaling index is less than 1.0; and if the plan increases shoaling, the shoaling index is greater than 1.0. Evaluation of the effectiveness of any given plan is based on the shoaling indices listed in the tables for each plan. Effects of the plans on tide heights at HOP are presented in Tables A19 and A20. Effects of the plans on current velocities at various locations in Southwest Pass are presented in Tables A21-A26. The current velocities were averaged over the tidal cycle for comparisons.

Shoaling results

7. Plan BA consisted of adding four dikes and four friction chambers on the west bank, and nine dikes on the east bank of Southwest Pass between miles 1.8 and 4.2 BHP. The clearance fairway between the dikes was approximately 1,420 ft. The locations of these dikes and friction chambers are shown in Plate A4. The shoaling patterns obtained for the three stages on the Carrollton gage (10, 14, and 18 ft) are presented in Plates A19, A20, and A21. Tests results are listed in Tables A2, A3, and A4 by individual sections and

summarized for two areas in Table A18. In area 1 the shoaling indices for the three stages were 1.04, 1.00, and 0.97 which indicates an increase in shoaling for the 10-ft stage and a reduction for the 18-ft stage. The area 2 shoaling indices were 0.94, 0.98, and 1.04. The reduction in shoaling was 6 and 2 percent for the 10- and 14-ft stages and a 4 percent increase for the 18-ft stage. Changes in shoaling percentages below 10 percent are considered insignificant with respect to model precision. The shoaling indices for the Gulf were 1.67 and 0.95 for the 14- and 18-ft stages, respectively. Due to the problem of retrieving all material that passed through the ends of the jetty, the Gulf shoaling indices are not accurate indicators of what will happen in nature. The overall shoaling in Southwest Pass was essentially unchanged with total shoaling indices of 1.00, 0.99, and 1.00 for the 10-, 14-, and 18-ft stages, respectively.

8. Plan BB consisted of adding two dikes and three friction chambers on the west bank of Southwest Pass between miles 5.5 and 8.1 BHP plus all the structures added in Plan BA. The location of these structures is shown in Plate A6. The total number of structures for Plan BB is 15 dikes and 7 friction chambers between miles 1.5 and 8.1 BHP. The shoaling patterns obtained for the three Carrollton gage river stages (10, 14, and 18 ft) are presented in Plates A22, A23, and A24. Test results, listed in Tables A5, A6, and A7 by individual sections and summarized in Table A18, indicate an 8 percent increase in shoaling in area 1 for the 10- and 14-ft stages and little change for the 18-ft stage. The shoaling indices for area 1 were 1.09, 1.08, and 0.99 for the 10-, 14-, and 18-ft stages, respectively. In area 2 there was a reduction in shoaling of 11 percent for the 10- and 14-ft stages, but a 12 percent increase for the 18-ft stage. The shoaling indices for area 2 were 0.89, 0.89, and 1.12 for the 10-, 14-, and 18-ft stages, respectively. Shoaling indices of 0.38 and 0.21 for the 14- and 18-ft stages in the Gulf indicate a decrease in the amount of material deposited in the Gulf. The overall shoaling in Southwest Pass was unchanged for the 10- and 14-ft stages, while for the 18-ft stage there was an increase in total shoaling of 4 percent (shoaling index of 1.04).

9. Plan BC consisted of adding 17 dikes and 3 friction chambers on the east bank and 3 friction chambers on the west bank of Southwest Pass between miles 9.8 and 12.5 BHP plus the structures previously added in Plans BA and BB. The clearance fairway between the dikes is approximately 1,420 ft.

Locations of these structures are shown in Plates A8 and A9. The total number of structures for Plan BC is 32 dikes and 13 friction chambers between miles 1.5 and 12.5 BHP. The shoaling patterns obtained for the three Carrollton gage river stages (10, 14, and 18 ft) are presented in Plates A25, A26 and A27. Test results, listed in Tables A8, A9, and A10 by individual sections and summarized in Table A18, indicate an increase in shoaling in area 1 for the 10- and 18-ft stages of 4 and 6 percent, respectively, and a slight 3 percent decrease for the 14-ft stage. The shoaling indices for area 1 are 1.05, 0.97, and 1.06 for the 10-, 14-, and 18-ft stages, respectively. None of these changes are significant with respect to model precision. In area 2, the shoaling indices for the three stages were 0.94, 1.00, and 0.81, which indicates an overall reduction in shoaling in that area for all three stages. The reduction was only 6 and 1 percent for the 10- and 14-ft stages, respectively, but a significant reduction of 19 percent for the 18-ft stage. The shoaling indices for the 14- and 18-ft stages in the Gulf were 2.50 and 1.70, respectively, which indicates an increase of 150 and 70 percent in the amount of material deposited in the Gulf. The overall shoaling in Southwest Pass was unchanged for the 10-ft stage tests, while for the 14- and 18-ft stage tests, the shoaling indices of 0.98 and 0.95, respectively, indicate a reduction in overall shoaling of 2 and 5 percent.

10. Plan BD consisted of adding 17 dikes and 4 friction chambers to the east bank and 4 friction chambers to the west bank of Southwest Pass between miles 12.5 and 17.0 BHP, plus the structures previously added to the channel for Plans BA, BB, and BC. The clearance fairway between the dikes is approximately 1,420 ft. Locations of these structures are shown in Plates A10 and A11. The total number of structures for Plan BD is 49 dikes and 21 friction chambers between miles 1.8 and 17.0 BHP. The shoaling patterns obtained for the three Carrollton gage river stages (10, 14, and 18 ft) are presented in Plates A28, A29, and A30. Test results, listed in Tables A11, A12, and A13 by individual sections and summarized in Table A18, indicate no overall change for areas 1 and 2 for the 10-ft stage. The shoaling indices for area 1 for the 14- and 18-ft stages are 0.93 and 0.89, respectively, and indicate a reduction of shoaling in this area. The reduction was only 7 percent for the 14-ft stage, but a reduction of 11 percent for the 18-ft stage. There was an increase in shoaling in area 2 for both stages with shoaling indices of 1.09 and 1.01. The shoaling indices in the Gulf were 1.29 and 1.91 which indicates

an increase of 29 and 91 percent in material deposited in the Gulf. The overall shoaling in Southwest Pass was unchanged (shoaling index 1.00) for the 10- and 14-ft stages, while there was a reduction in overall shoaling of 6 percent (shoaling index 0.94) for the 18-ft stage.

11. Plan BE involves reducing the clearance fairway width between the ends of dikes from 1,420 ft to approximately 1,200 ft. This was accomplished by extending the lengths of all the dikes (both existing and Plans BA-BD additions) in Southwest Pass from miles 1.8 to 17.0 BHP plus extending the length of 11 dikes between miles 17.0 and 19.3 BHP. Plates A12 and A13 show the elements of the plan and the extension of these dikes. For this plan, only tests for the 14- and 18-ft stages were conducted. The shoaling patterns obtained for these two Carrollton gage river stages are presented in Plates A31 and A32. Test results, listed in Tables A14 and A15 by individual sections and summarized in Table A18, indicate no significant shoaling reductions in area 1 with shoaling indices of 0.99 and 0.98 for the 14- and 18-ft stages, respectively. The shoaling indices of 1.04 and 1.06 for area 2 indicate an overall increase in the shoaling in this area (which is not considered significant with respect to model precision), while the Gulf had a reduction in material deposited with shoaling indices of 0.54 and 0.58 for the 14- and 18-ft stages, respectively. The overall shoaling in Southwest Pass was unchanged for the 14-ft stage and there was a 2 percent increase in shoaling (shoaling index 1.02) for the 18-ft stage.

12. Plan BF is similar to Plan BE in that Plan BF reduces the clearance fairway between the dikes in Plan BE from 1,200 to 1,000 ft. As in Plan BE, tests were conducted for only the 14- and 18-ft stages. Plates A14 and A15 show the elements of the plan and the extension of the dikes. The shoaling patterns obtained for the two Carrollton gage river stages are presented in Plates A33 and A34. Test results, listed in Tables A16 and A17 by individual sections and summarized in Table A18, indicate a insignificant reduction of shoaling in area 1 and a slight increase in shoaling in area 2 for the 14-ft stages with shoaling indices of 0.99 and 1.04, respectively. For the 18-ft stage, area 1 had a shoaling index of 1.09, a 9 percent increase in shoaling, while the shoaling index for area 2 was 0.96, a reduction of 4 percent. For both stages, no shoal material was deposited in the Gulf. There was a slight increase in overall shoaling for both the 14- and 18-ft stages of 1 and 5 percent, respectively. The corresponding shoaling indices were 1.01 and 1.05.

Discussion of shoaling results

13. Results of tests involving adding additional dikes and friction chambers (Plans BA, BB, BC, and BD) and the extensions of existing and proposed dikes (Plans BE and BF) indicate very minor overall changes in shoaling in Southwest Pass. Changes in the existing shoaling would be a redistribution of the shoal material in Southwest Pass. The largest benefits in area 1 (miles 8.4 to 14.8 and model sections 50-76) occurred for Plan BD, for the 14- and 18-ft Carrollton river stages which indicated a reduction in shoaling of 7 and 11 percent, respectively (shoaling indices of 0.93 and 0.89). A corresponding increase of 9 and 1 percent (shoaling indices of 1.09 and 1.01) in shoaling was indicated in area 2 for the same test conditions. The largest benefits in area 2 (miles 14.8 to 20.4 and model sections 77-98) occurred in Plan BB which indicated a reduction in shoaling of 11 percent for the 10- and 14-ft Carrollton gage river stages. The shoaling index was 0.89 for both the 10- and 14-ft stages. A corresponding increase in shoaling of 9 and 8 percent (shoaling indices of 1.09 and 1.08) was indicated in area 1 for the same test conditions. An overall reduction in shoaling of 3 percent was indicated in area 1 for Plan BC during the 14-ft stage test condition. The results of the 18-ft stage test for Plan BC indicate a reduction in shoaling of 19 percent (shoaling index 0.81) for area 2 with a corresponding increase in shoaling of 6 percent (shoaling index 1.06) for area 1. None of the plans caused flushing of a significant quantity of shoal material into the Gulf. Results of all the plan tests show little or no change in the overall shoaling in Southwest Pass for the 10- and 14-ft stages. For the 18-ft stage tests, Plans BC and BD indicated a reduction in overall shoaling of 5 and 6 percent, respectively (shoaling indices of 0.95 and 0.94). Plans BB, BE, and BF indicate increases in overall shoaling of 4, 2, and 5 percent, respectively.

Tide heights at Head of Passes

14. Tables A19 and A20 present the effects of Plans BA-BF on the tide heights at HOP. The tables list the high- and low-water readings for the tidal cycle plus the overall tide range for the plans as compared with the base. For Plans BA and BB, there was very little change in the tide at HOP as seen in Table A19 for the three Carrollton gage river stages. The effects of Plans BC and BD indicated a lowering of the tide plane at HOP of approximately 1.0, 1.2, and 0.6 ft for the 10-, 14-, and 18-ft stages, respectively. Test results for Plan BE are presented in Table A20 and indicated a lowering of the

tide plane of approximately 1.1 and 0.5 ft for the 14- and 18-ft stages, respectively, while Plan BF lowered the tide plane approximately 1.0 and 0.6 ft.

Discussion of tide results

15. Results of tests indicated very little change in tidal heights at HOP for Plans BA and BB. For Plans BC, BD, BE, and BF, the reductions in tide plane from base to plan vary from -0.5 to -1.2 ft. These reductions in tide plane are indicated for both high- and low-water elevations; therefore the tidal ranges were generally unchanged.

Current velocities

16. Current velocities were measured at three depths (surface, mid-depth, and bottom) and averaged over the tidal cycle. The data were measured at various center-line stations depending on the plan tested. For Plan BA the stations were miles 1.5, 3.0, and 5.0 BHP; for Plan BB, miles 5.0, 7.0, 9.0, and 11.0 BHP; for Plan BC, 9.0, 11.0, 12.0, and 15.0 BHP; and for Plans BD, BE, and BF, miles 11.0, 12.0, 15.0, and 17.0 BHP. Velocity changes above 0.5 fps were considered significant.

17. Plan BA. The effects of Plan BA on current velocities in Southwest Pass are presented in Table A21 for the three tested Carrollton gage river stages (10, 14, and 18 ft). At station miles 1.5 and 5.0 BHP, above and below the addition of the Plan BA dikes, a slight overall reduction in average velocities was observed. Significant changes in velocity occurred at mile 1.5 at the surface and middepth for the 14- and 18-ft stages with a decrease in the average velocity of from 0.6 to 0.9 fps. At station mile 3.0, in the center of the dike field, the average velocity increased significantly on the surface for the 10-ft stage, and at all three depths for stages of 14 and 18 ft. The maximum increases were 1.8, 1.7, and 1.6 fps at the surface, mid-depth, and bottom, respectively.

18. Plan BB. The effects of Plan BB on current velocities in Southwest Pass at station miles 5.0, 7.0, 9.0, and 11.0 BHP are presented in Table A22 for the three Carrollton gage river stages (10, 14, and 18 ft). Test results indicated very little overall change in velocities for Plan BB at station miles 5.0, 7.0, and 11.0 BHP for the 10- and 14-ft stages. For the 18-ft stage, the velocities at station mile 9.0, just downstream of the added dikes and friction chambers, showed an increase of approximately 1.2 fps for the surface, middepth, and bottom depths. Station mile 11.0 showed only a slight indication of an increase in velocities.

19. Plan BC. The effects of Plan BC on current velocities in Southwest Pass at station miles 9.0, 11.0, 12.0, and 15.0 BHP are presented in Table A23 for the three Carrollton gage river stages (10, 14, and 18 ft). Test results indicated very little change in velocities for Plan BC with the exception of the 18-ft stage test at station mile 9.0 BHP. The velocities there showed an increase of between 0.8 to 1.4 fps for the three depths. This was noted in Plan BB and is not a reflection of effects of Plan BC at this location.

20. Plan BD. The effects of Plan BD on current velocities in Southwest Pass at station miles 11.0, 12.0, 15.0, and 17.0 BHP are shown in Table A24 for the three Carrollton gage river stages (10, 14, and 18 ft). Test results indicated little change in velocities at station miles 11.0, 12.0, and 15.0 BHP, for the three test stages. At station mile 17.0 BHP, there was a significant increase in velocity varying from 0.7 fps at middepth to 1.3 fps at the bottom for the 14- and 18-ft stages. Station mile 17.0 is just downstream of the dike and friction chamber field.

21. Plan BE. The effects of Plan BE on current velocities in Southwest Pass at station miles 11.0, 12.0, 15.0, and 17.0 BHP are shown in Table A25 for two Carrollton gage river stages (14 and 18 ft). Test results indicated an increase of 0.8 to 0.9 fps in velocities at station miles 11.0 and 17.0 BHP for the 14-ft stage, and decreases in velocities of between 0.5 to 0.7 fps at station miles 12.0 and 15.0 BHP for the 18-ft stage.

22. Plan BF. The effects of Plan BF on current velocities in Southwest Pass at station miles 11.0, 12.0, 14.0, and 17.0 BHP are presented in Table A26 for two Carrollton gage river stages (14 and 18 ft). Test results indicated a significant increase in velocity at station miles 15.0 and 17.0 BHP for both test stages. There was an increase of approximately 1.3 fps at these stations for the 14-ft stage and an increase of approximately 1.2 fps for the 18-ft stage.

Discussion of velocity results

23. The only significant increase in tidal cycle averaged velocities occurred with Plans BD, BE, and BF and Carrollton gage stages of 14 and 18 ft. Maximum velocity increases between 0.9 to 1.3 fps occurred at miles 15 and 17 with Plan BF. Plan BF had a clear width of 1,000 ft between the dikes between miles 1.8 and 19.3 BHP. Increases in average velocities generally occurred at stations in the center of or just downstream of the added dike fields or extensions.

PART III: DISCUSSION AND CONCLUSIONS

24. The purpose of the report was to describe model test results of plans that were intended to reduce channel shoaling by the addition of structures in Southwest Pass. Shoaling results of model tests involving addition of dikes, addition of friction chambers, and extension of the existing and added dikes between miles 1.8 and 19.3 BHP indicated that no significant benefits would be realized. The most significant change in the model test shoaling results indicates there would be a redistribution of the shoal material in Southwest Pass. None of the plans tested caused movement of a significant quantity of shoal material into the Gulf. However, results of the hydraulic tests indicated that the current velocities generally increased at most channel stations for all plans. This usually indicates a reduction in shoaling in the channel as additional dikes and extensions of dikes are added, even though the shoaling results did not confirm this. This may have been caused by local velocity increases but greater energy loss between the dikes. Infilling of sediment between the dikes might eventually alter this apparent contradiction.

Table A1
Shoaling Material Injection Rate and Time of Injection
from Mile 8.4 to Tip of Salinity Intrusion

<u>Model</u> <u>Tidal Cycles</u>	<u>Hour</u>	<u>Amount of Material</u> <u>cc</u>	
1-3		0	Model stability
4	0	5,000	
	6	1,500	
	12		
	18		
5	0		
	6		
	12		
	18		
6	0		
	6		
	12		
	18		
7	0		
	6		
	12		
	18		
8	0		
	6	1,000	
	12		
	18		
9	0		
	6		
	12		
	18		
		<u>36,000</u>	Total material injected

Table A2
Plan BA, Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	400	930	2.33	77	1,100	820	0.74
51	1,080	965	0.89	78	860	750	0.87
52	1,205	975	0.81	79	940	790	0.84
53	1,010	820	0.81	80	825	850	1.03
54	1,260	705	0.56	81	900	915	1.01
55	790	820	1.04	82	700	460	0.66
56	680	840	1.24	83	970	1,180	1.21
57	760	810	1.07	84	990	890	0.89
58	580	780	1.34	85	750	925	1.23
59	580	810	1.39	86	1,250	1,020	0.81
60	635	900	1.42	87	1,150	785	0.68
61	820	610	0.74	88	785	715	0.91
62	650	770	1.18	89	890	940	1.05
63	540	790	1.46	90	925	850	0.91
64	650	675	1.04	91	800	1,100	1.37
65	650	655	1.00	92	720	1,040	1.44
66	600	720	1.20	93	225	530	2.35
67	325	655	2.01	94	560	80	0.14
68	775	750	0.96	95	255	80	0.31
69	460	755	1.64	96	--	--	--
70	680	880	1.29	97	--	--	--
71	780	890	1.14	98	--	--	--
72	850	750	0.88				
73	830	740	0.88				
74	940	800	0.85	Subtotal			
75	1,225	800	0.65	77-98	15,505	14,720	0.94
76	670	720	1.07	Total	36,020	36,035	1.00
Subtotal				Gulf	--	--	--
50-76	20,425	21,315	1.04				

Note: Plan BA included the addition of 13 lateral spur dikes and 4 friction chambers between miles 1.8 and 4.1 BHP. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A3
Plan BA, Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	290	120	0.41	77	810	1,400	1.73
51	280	360	1.29	78	620	700	1.10
52	1,200	1,700	1.41	79	760	600	0.79
53	740	570	0.77	80	100	670	6.70
54	725	1,030	1.42	81	850	820	0.96
55	845	800	0.95	82	435	80	0.18
56	550	625	1.13	83	1,250	1,220	0.98
57	895	1,175	1.31	84	1,120	1,235	1.10
58	400	285	0.71	85	360	125	0.34
59	1,100	1,190	1.08	86	1,500	1,350	0.90
60	540	380	0.70	87	600	480	0.80
61	700	625	0.89	88	160	20	0.30
62	710	640	0.90	89	1,890	1,700	0.90
63	290	580	2.00	90	150	140	0.93
64	1,200	940	0.78	91	650	1,480	2.28
65	550	840	1.52	92	1,485	1,120	0.75
66	1,010	620	0.61	93	50	100	2.00
67	20	615	30.75	94	1,440	500	0.35
68	60	440	7.33	95	--	--	--
69	360	500	1.39	96	--	--	--
70	975	1,430	1.47	97	610	800	1.31
71	1,140	100	0.09	98	--	--	--
72	2,140	1,760	0.82				
73	975	500	0.51				
74	700	950	1.36				
75	1,575	1,560	0.95				
76	900	575	0.64				
Subtotal				Subtotal			
50-76	20,870	20,850	1.00	77-98	14,840	14,540	0.98
				Total	35,710	35,390	0.99
				Gulf	260	435	1.67

Note: Plan BA included the addition of 13 lateral spur dikes and 4 friction chambers between miles 1.8 and 4.1 BHP. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A4
Plan BA, Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	--	200	--
51	--	--	--	78	1,000	2,395	2.40
52	720	600	0.83	79	990	--	--
53	230	390	1.70	80	--	200	--
54	645	550	0.85	81	--	--	--
55	1,205	1,149	0.95	72	--	--	--
56	255	550	2.44	83	--	150	--
57	1,020	860	0.84	84	4,260	4,065	0.95
58	580	2,060	3.55	85	--	225	--
59	620	20	0.03	86	--	--	--
60	1,620	1,440	0.89	87	2,740	280	0.10
61	--	280	--	88	--	450	--
62	--	170	--	89	--	575	--
63	--	--	--	90	--	--	--
64	--	--	--	91	--	--	--
65	1,235	760	0.62	92	--	--	--
66	520	1,240	2.38	93	--	550	--
67	--	55	--	94	300	1,410	4.70
68	--	55	--	95	3,005	--	--
69	--	--	--	96	--	--	--
70	--	--	--	97	--	200	--
71	--	--	--	98	2,695	4,855	1.80
72	3,510	1,300	0.37				
73	3,405	3,640	1.07	Subtotal			
74	--	--	--	77-98	14,990	15,555	1.04
75	2,855	2,625	0.92	Total	34,130	34,075	1.00
76	700	785	1.12	Gulf	2,120	2,010	0.95
Subtotal							
50-76	19,140	18,520	0.97				

Note: Plan BA included the addition of 13 lateral spur dikes and 4 friction chambers between miles 1.8 and 4.1 BHP. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A5
Plan BB, Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	400	680	0.17	77	1,100	900	0.81
51	1,080	975	0.90	78	860	820	0.95
52	1,205	915	0.76	79	940	865	0.92
53	1,010	1,020	1.01	80	825	690	0.83
54	1,260	880	0.69	81	900	825	0.91
55	790	720	0.91	82	700	850	1.21
56	680	790	1.16	83	970	940	0.97
57	760	805	1.05	84	990	660	0.67
58	580	780	1.34	85	750	665	0.89
59	580	850	1.46	86	1,250	850	0.68
60	635	845	1.33	87	1,150	670	0.58
61	820	835	1.01	88	785	675	0.86
62	650	850	1.30	89	890	1,000	1.12
63	540	605	1.12	90	925	735	0.79
64	650	840	1.29	91	800	1,060	1.32
65	650	710	1.09	92	720	765	1.06
66	600	810	1.35	93	225	665	2.95
67	325	650	2.00	94	560	100	0.18
68	775	840	1.08	95	255	100	0.39
69	460	640	1.45	96	--	--	--
70	680	700	1.02	97	--	--	--
71	780	1,220	1.56	98	--	--	--
72	850	750	0.88				
73	830	910	1.09	Subtotal			
74	940	900	0.95	77-98	15,595	13,385	0.89
75	1,225	820	0.67	Total	36,020	36,010	1.00
76	670	835	1.24	Gulf	--	--	--
Subtotal							
50-76	20,425	22,175	1.09				

Note: Plan BB included the addition of 2 lateral spur dikes and 3 friction chambers between miles 5.5 and 8.1 BHP plus the elements of Plan BA. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A6
Plan BB, Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	290	410	1.41	77	810	890	1.10
51	280	630	2.25	78	620	730	1.18
52	1,200	1,000	0.83	79	760	560	0.74
53	740	1,110	1.50	80	100	460	4.60
54	725	1,200	1.66	81	850	560	0.66
55	845	960	1.14	82	435	370	0.85
56	550	610	1.11	83	1,250	1,120	0.90
57	895	1,310	1.46	84	1,120	1,000	0.89
58	400	470	1.18	85	360	90	0.25
59	1,100	1,430	1.30	86	1,500	495	0.33
60	540	715	1.32	87	600	1,185	1.98
61	700	750	1.07	88	160	115	0.72
62	710	750	1.05	89	1,890	1,235	0.65
63	290	550	1.90	90	150	855	5.70
64	1,200	990	0.83	91	650	1,000	1.54
65	550	780	1.41	92	1,485	720	0.48
66	1,010	840	1.01	93	50	635	12.70
67	20	120	0.35	94	1,440	135	0.09
68	60	1,410	23.50	95	--	--	--
69	360	40	0.11	96	--	--	--
70	975	1,370	1.41	97	670	1,130	1.85
71	1,140	150	0.13	98	--	--	--
72	2,140	1,950	0.91				
73	975	640	0.66	Subtotal			
74	700	670	0.96	77-98	14,840	13,285	0.89
75	1,575	1,280	0.81	Total	35,710	35,915	1.00
76	900	495	0.55	Gulf	260	100	0.38
Subtotal 50-76	20,870	22,630	1.08				

Note: Plan BB included the addition of 2 lateral spur dikes and 3 friction chambers between miles 5.5 and 8.1 BHP plus the elements of Plan BA. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A7
Plan BB, Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	--	1,600	--
51	--	--	--	78	1,000	1,200	1.20
52	720	960	1.33	79	990	720	0.73
53	230	270	1.17	80	--	250	--
54	645	760	1.18	81	--	460	--
55	1,205	1,260	1.04	82	--	--	--
56	255	180	0.71	83	--	10	--
57	1,020	1,280	1.25	84	4,260	2,330	0.55
58	580	460	0.79	85	--	340	--
59	620	1,180	1.90	86	--	320	--
60	1,620	580	0.36	87	2,740	1,620	0.59
61	--	100	--	88	--	--	--
62	--	890	--	89	--	500	--
63	--	--	--	90	--	475	--
64	--	--	--	91	--	--	--
65	1,235	2,090	1.69	92	--	1,830	--
66	520	500	0.96	93	--	--	--
67	--	--	--	94	300	915	3.05
68	--	--	--	95	3,005	1,700	0.57
69	--	--	--	96	--	--	--
70	--	30	--	97	--	175	--
71	--	--	--	98	2,695	2,280	0.85
72	3,510	4,190	1.19				
73	3,405	--	--	Subtotal			
74	--	390	--	77-98	14,990	16,725	1.12
75	2,855	3,730	1.31				
76	700	--	--	Total	34,130	35,575	1.04
Subtotal				Gulf	2,120	450	0.21
50-76	19,120	18,850	0.99				

Note: Plan BB included the addition of 2 lateral spur dikes and 3 friction chambers between miles 5.5 and 8.1 BHP plus the elements of Plan BA. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A8
Plan BC, Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	400	760	1.90	77	1,100	630	0.57
51	1,080	820	0.76	78	860	700	0.81
52	1,205	755	0.63	79	940	680	0.72
53	1,010	1,005	0.99	80	825	835	1.01
54	1,260	680	0.54	81	900	820	0.91
55	790	670	0.85	82	700	625	0.89
56	680	790	1.16	83	970	1,220	1.25
57	760	675	0.89	84	990	855	0.86
58	580	635	1.09	85	750	480	0.64
59	580	795	1.37	86	1,250	1,020	0.82
60	635	620	0.97	87	1,150	815	0.71
61	820	830	1.01	88	785	670	0.85
62	650	670	1.03	89	890	900	1.01
63	540	640	1.18	90	925	820	0.89
64	650	750	1.15	91	800	1,025	1.28
65	650	670	1.03	92	720	1,110	1.54
66	600	790	1.32	93	225	950	4.22
67	325	720	2.22	94	560	275	0.49
68	775	1,050	1.35	95	255	210	0.82
69	460	550	1.19	96	--	--	--
70	680	900	1.32	97	--	--	--
71	780	1,080	1.38	98	--	--	--
72	850	890	1.05				
73	830	875	1.05				
74	940	950	1.01	Subtotal			
75	1,225	1,100	0.89	77-98	15,595	14,640	0.94
76	670	700	1.04	Total	36,020	36,010	1.00
Subtotal				Gulf	--	--	--
50-76	20,425	21,370	1.05				

Note: Plan BC included the addition of 17 lateral spur dikes and 6 friction chambers between miles 4.8 and 12.5 BHP plus the elements of Plans 3A and BB. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the case test.

Table A9
Plan BC, Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	290	340	1.17	77	810	1,350	1.67
51	280	310	1.11	78	620	590	0.95
52	1,200	1,515	1.26	79	760	880	1.15
53	740	735	0.99	80	100	570	5.70
54	725	1,220	1.68	81	850	710	0.84
55	845	750	0.89	82	435	--	--
56	550	590	1.07	83	1,250	1,050	0.84
57	895	810	0.90	84	1,120	1,640	1.46
58	400	740	1.85	85	360	100	0.28
59	1,100	880	0.80	86	1,500	1,610	1.07
60	540	545	1.01	87	600	240	0.40
61	700	680	0.97	88	160	20	0.13
62	710	705	0.99	89	1,890	1,360	0.72
63	290	555	1.91	90	150	40	0.27
64	1,200	655	0.55	91	650	1,720	2.65
65	550	770	1.40	92	1,485	60	0.04
66	1,010	740	0.73	93	50	1,320	26.40
67	20	30	1.50	94	1,440	260	0.18
68	60	270	4.50	95	--	560	--
69	360	400	1.11	96	--	--	--
70	975	1,105	1.13	97	610	690	1.13
71	1,140	810	0.71	98	--	--	--
72	2,140	2,195	1.03				
73	975	635	0.65				
74	700	355	0.51	Subtotal			
75	1,575	1,635	1.04	77-98	14,840	14,770	1.00
76	900	350	0.39	Total	35,710	35,095	0.98
Subtotal				Gulf	260	650	2.50
50-76	20,875	20,325	0.97				

Note: Plan BB included the addition of 17 lateral spur dikes and 6 friction chambers between miles 9.8 and 12.5 BHP plus the elements of Plans BA and BB. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A10
Plan BC, Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	--	340	--
51	--	--	--	78	1,000	1,160	1.60
52	720	950	1.32	79	990	870	0.88
53	230	30	0.13	80	--	30	--
54	645	830	1.29	81	--	--	--
55	1,205	900	0.75	82	--	--	--
56	255	680	2.67	83	--	--	--
57	1,020	930	0.91	84	4,260	4,260	1.00
58	580	1,710	2.95	85	--	140	--
59	620	30	0.04	86	--	--	--
60	1,620	--	--	87	2,740	1,500	0.55
61	--	--	--	88	--	--	--
62	--	1,400	--	89	--	--	--
63	--	720	--	90	--	--	--
64	--	820	--	91	--	--	--
65	1,235	30	0.02	92	--	--	--
66	520	--	--	93	--	--	--
67	--	--	--	94	300	--	--
68	--	--	--	95	3,005	--	--
69	--	910	--	96	--	--	--
70	--	--	--	97	--	--	--
71	--	--	--	98	2,695	3,785	1.40
72	3,510	3,900	1.11				
73	3,405	2,100	0.62	Subtotal			
74	--	1,530	--	77-98	14,990	12,085	0.81
75	2,855	1,310	0.46	Total	34,130	32,405	0.95
76	700	1,540	2.20	Gulf	2,120	3,610	1.70
Subtotal							
50-76	19,120	20,320	1.06				

Note: Plan BC included the addition of 17 lateral spur dikes and 6 friction chambers between miles 9.8 and 12.5 BHP plus the elements of Plans BA and BB. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A11
Plan BD, Carrollton Stage 10 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	400	615	1.53	77	1,100	715	0.65
51	1,080	1,120	1.03	78	860	690	0.80
52	1,205	1,050	0.87	79	940	690	0.73
53	1,010	825	0.82	80	825	725	0.88
54	1,260	885	0.70	81	900	940	1.04
55	790	800	1.01	82	700	835	1.19
56	680	760	1.11	83	970	810	0.84
57	760	800	1.05	84	990	800	0.81
58	530	620	1.07	85	750	800	1.07
59	580	810	1.39	86	1,250	935	0.75
60	635	710	1.11	87	1,150	840	0.73
61	820	705	0.86	88	785	865	1.10
62	650	750	1.15	89	890	990	1.11
63	540	740	1.37	90	925	900	0.97
64	650	805	1.23	91	800	1,150	1.44
65	650	745	1.15	92	720	1,180	1.64
66	600	710	1.18	93	225	540	2.40
67	325	460	1.42	94	560	940	1.68
68	775	815	1.05	95	255	200	0.78
69	460	440	0.96	96	--	--	--
70	680	720	1.06	97	--	--	--
71	780	900	1.15	98	--	--	--
72	850	630	0.74				
73	830	800	0.96				
74	940	580	0.62	Subtotal			
75	1,225	965	0.79	77-98	15,595	15,545	1.00
76	670	700	1.04	Total	36,020	36,005	1.00
Subtotal				Gulf	--	--	--
50-76	20,425	20,460	1.00				

Note: Plan BD included the addition of 17 lateral spur dikes and 8 friction chambers between miles 12.5 and 17.0 BHP plus the elements of Plans BA, BB, and BC. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Plan BD, Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	290	390	1.34	77	810	1,800	2.22
51	280	350	1.30	78	620	420	0.68
52	1,200	1,370	1.14	79	760	740	0.97
53	740	950	1.28	80	100	410	4.10
54	725	920	1.27	81	850	1,020	1.20
55	845	835	0.99	82	435	535	1.22
56	550	610	1.11	83	1,250	1,045	0.84
57	895	980	1.09	84	1,120	1,330	1.19
58	400	835	2.09	85	360	135	0.38
59	1,100	1,130	1.03	86	1,500	1,950	1.30
60	540	400	0.74	87	600	285	0.48
61	700	230	0.33	88	160	10	0.06
62	710	785	1.11	89	1,890	1,420	0.75
63	290	760	2.62	90	150	130	0.87
64	1,200	50	0.04	91	650	85	0.13
65	550	1,175	2.14	92	1,485	1,680	1.13
66	1,010	710	0.70	93	50	665	13.30
67	20	10	0.50	94	1,440	675	0.47
68	60	--	--	95	--	985	--
69	360	1,150	3.19	96	--	20	--
70	975	740	0.76	97	610	800	1.31
71	1,140	830	0.73	98	--	65	--
72	2,140	1,500	0.70				
73	975	480	0.49				
74	700	600	0.86				
75	1,575	1,580	1.00				
76	900	100	0.11				
Subtotal 50-76	20,870	19,470	0.93	Subtotal 77-98	1-,840	16,205	1.09
				Total	35,710	35,675	1.00
				Gulf	260	335	1.29

Note: Plan BD included the addition of 17 lateral spur dikes and 8 friction chambers between miles 12.5 and 17.0 BHP plus the elements of Plans BA, BB, and BC. The shoaling index for a plan is determined by dividing the total shoaling volume of a reach section in the plan test by the total shoaling volume of a reach section in the base test.

Table A13
Plan BD, Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	--	465	--
51	--	--	--	78	1,000	3,690	3.69
52	720	510	0.71	79	990	420	0.42
53	230	410	1.78	80	--	210	--
54	645	290	0.45	81	--	480	--
55	1,205	1,500	1.24	82	--	--	--
56	255	--	--	83	--	600	--
57	1,020	100	0.09	84	4,260	830	0.19
58	580	2,520	4.34	85	--	1,830	--
59	620	800	1.29	86	--	--	--
60	1,620	315	0.19	87	2,740	2,980	1.08
61	--	--	--	88	--	575	--
62	--	1,200	--	89	--	--	--
63	--	1,340	--	90	--	--	--
64	--	--	--	91	--	--	--
65	1,235	20	0.02	92	--	--	--
66	520	40	0.08	93	--	--	--
67	--	450	--	94	300	--	--
68	--	--	--	95	3,005	--	--
69	--	--	--	96	--	--	--
70	--	--	--	97	--	--	--
71	--	480	--	98	2,695	2,990	1.11
72	3,510	4,640	1.32				
73	3,405	2,350	0.69	Subtotal			
74	--	--	--	77-98	14,990	15,070	1.01
75	2,855	--	--	Total	34,130	32,035	0.94
76	700	--	--	Gulf	2,120	4,055	1.91
Subtotal							
50-76	19,120	16,965	0.89				

Note: Plan BD included the addition of 17 lateral spur dikes and 8 friction chambers between miles 12.5 and 17.0 BHP plus the elements of Plans BA, BB, and BC. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A14
Plan BE, Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	290	625	2.16	77	810	860	1.06
51	280	870	3.11	78	620	125	0.20
52	1,200	1,345	1.12	79	760	945	1.24
53	740	940	1.27	80	100	840	8.40
54	725	980	1.35	81	850	975	1.14
55	845	750	0.89	82	435	425	0.98
56	550	960	1.75	83	1,250	--	--
57	895	270	0.30	84	1,120	1,480	1.32
58	400	610	1.53	85	360	1,180	3.28
59	1,100	690	0.63	86	1,500	1,170	0.78
60	540	1,170	2.17	87	600	720	1.20
61	700	410	0.59	88	160	--	--
62	710	--	--	89	1,890	1,300	0.69
63	290	1,320	4.55	90	150	550	3.67
64	1,200	--	--	91	650	--	--
65	550	950	1.73	92	1,485	760	0.51
66	1,010	850	0.84	93	50	910	18.20
67	20	890	44.50	94	1,440	--	--
68	60	450	7.50	95	--	600	--
69	360	960	2.67	96	--	170	--
70	975	--	--	97	610	2,420	3.97
71	1,140	1,740	1.53	98	--	--	--
72	2,140	610	0.29				
73	975	630	0.65	Subtotal			
74	700	240	0.34	77-98	14,840	15,430	1.04
75	1,575	980	0.62	Total	35,710	35,870	1.00
76	900	1,200	1.33	Gulf	260	140	0.54
Subtotal							
50-76	20,595	20,440	0.99				

Note: Plan BE included the extension of all the dikes in Southwest Pass from miles 1.8 to 19.3 BHP to reduce the effective width between the dikes from approximately 1,420 to 1,200 ft. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A15
Plan BE, Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	--	--	77	--	350	--
51	--	190	--	78	1,000	180	0.18
52	720	1,405	1.95	79	990	1,380	1.39
53	230	670	2.91	80	--	1,015	--
54	645	3,320	0.05	81	--	420	--
55	1,205	1,440	1.20	82	--	40	--
56	255	310	1.22	83	--	--	--
57	1,020	--	--	84	4,260	--	--
58	580	1,020	1.76	85	--	1,240	--
59	620	1,300	2.10	86	--	2,855	--
60	1,620	130	0.08	87	2,740	200	0.07
61	--	910	--	88	--	--	--
62	--	--	--	89	--	--	--
63	--	--	--	90	--	--	--
64	--	--	--	91	--	1,700	--
65	1,235	--	--	92	--	1,110	--
66	520	2,515	4.84	93	--	30	--
67	--	2,060	--	94	300	--	--
68	--	--	--	95	3,005	--	--
69	--	--	--	96	--	--	--
70	--	--	--	97	--	375	--
71	--	635	--	98	2,695	5,050	1.87
72	3,510	840	0.24				
73	3,405	710	0.21	Subtotal			
74	--	1,010	--	77-98	14,990	15,945	1.06
75	2,855	360	0.13	Total	34,130	34,770	1.02
76	700	3,000	4.29	Gulf	2,120	1,240	0.58
Subtotal 50-76	19,120	18,825	0.98				

Note: Plan BE included the extension of all the dikes in Southwest Pass from miles 1.8 to 19.3 BHP to reduce the effective width between the dikes from approximately 1,420 to 1,200 ft. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model sections in the test.

Table A16
Plan BF, Carrollton Stage 14 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	290	680	2.34	77	810	--	--
51	280	1,180	4.21	78	620	1,830	2.95
52	1,200	1,180	0.98	79	760	--	--
53	740	840	1.14	80	100	200	2.00
54	725	920	1.27	81	850	2,515	2.96
55	845	770	0.91	82	435	110	0.25
56	550	70	0.13	83	1,250	--	--
57	895	790	0.88	84	1,120	--	--
58	400	970	2.43	85	360	335	0.93
59	1,100	450	0.41	86	1,500	1,590	1.06
60	540	1,495	2.77	87	600	2,460	4.10
61	700	290	0.41	88	160	--	--
62	710	--	--	89	1,890	610	0.32
63	290	60	0.21	90	150	1,225	3.16
64	1,200	1,540	1.28	91	650	--	--
65	550	480	0.87	92	1,485	1,240	0.84
66	1,010	--	--	93	50	2,075	41.50
67	20	1,450	72.50	94	1,440	60	0.04
68	60	690	11.50	95	--	640	--
69	360	1,320	1.18	96	--	50	--
70	975	--	--	97	610	500	0.82
71	1,140	1,340	1.18	98	--	--	--
72	2,140	920	0.43				
73	975	660	0.68				
74	700	--	--				
75	1,575	1,100	0.70	Subtotal			
76	900	1,380	1.53	77-98	14,850	15,440	1.04
Subtotal				Total	35,710	36,015	1.01
50-76	20,870	20,575	0.99	Gulf	260	--	--

Note: Plan BF included the extension of all the dikes in Southwest Pass from miles 1.8 to 19.3 BHP to reduce the effective width between the dikes from approximately 1,200 to 1,000 ft. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A17
Plan BF, Carrollton Stage 18 ft

Model Section	Base cc	Plan cc	Shoaling Index	Model Section	Base cc	Plan cc	Shoaling Index
50	--	560	--	77	--	--	--
51	--	1,040	--	78	1,000	--	--
52	720	830	1.15	79	990	--	--
53	230	850	3.70	80	--	--	--
54	645	860	1.33	81	--	2,350	--
55	1,205	720	0.60	82	--	85	--
56	255	90	0.35	83	--	--	--
57	1,020	30	0.18	84	4,260	--	--
58	580	640	1.10	85	--	--	--
59	620	950	1.53	86	--	340	--
60	1,620	--	--	87	2,740	3,880	1.42
61	--	550	--	88	--	--	--
62	--	--	--	89	--	180	--
63	--	--	--	90	--	875	--
64	--	3,180	--	91	--	60	--
65	1,235	--	--	92	--	515	--
66	520	--	--	93	--	1,930	--
67	--	--	--	94	300	--	--
68	--	1,700	--	95	3,005	1,380	0.46
69	--	3,045	--	96	--	--	--
70	--	--	--	97	--	2,135	--
71	--	950	--	98	2,695	725	0.27
72	3,510	--	--				
73	3,405	1,520	0.45	Subtotal			
74	--	--	--	77-98	14,990	14,455	0.96
75	2,855	100	0.04	Total	34,130	36,005	1.05
76	700	3,785	5.41	Gulf	2,120	--	--
Subtotal							
50-76	19,820	21,550	1.09				

Note: Plan BF included the extension of all the dikes in Southwest Pass from miles 1.8 to 19.3 BHP to reduce the effective width between the dikes from approximately 1,200 to 1,000 ft. The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the case test.

Table A18
Summary of Shoaling Indices*

Area 1 Miles 8.4-14.8		Area 2 Miles 14.8-20.4		Total Miles 8.4-20.4	
<u>Plan</u>	<u>Sections 50-76</u>	<u>Sections 77-98</u>	<u>Sections 50-98</u>	<u>Gulf</u>	
<u>10-ft Stage</u>					
BA	1.04	0.94	1.00	--	
BB	1.09	0.89	1.00	--	
BC	1.05	0.94	1.00	--	
BD	1.00	1.00	1.00	--	
<u>14-ft Stage</u>					
BA	1.00	0.98	0.99	1.67	
BB	1.08	0.89	1.00	0.38	
BC	0.97	1.00	0.98	2.50	
BD	0.93	1.09	1.00	1.29	
BE	0.99	1.04	1.00	0.54	
BF	0.99	1.04	1.01	--	
<u>18-ft Stage</u>					
BA	0.97	1.04	1.00	0.95	
BB	0.99	1.12	1.04	0.21	
BC	1.06	0.81	0.95	1.70	
BD	0.89	1.01	0.94	1.91	
BE	0.98	1.06	1.02	0.58	
BF	1.09	0.96	1.05	--	

* The shoaling index for a plan is determined by dividing the total shoaling volume of a model section in the plan test by the total shoaling volume of a model section in the base test.

Table A19
Effects of Plans on Tide Heights* at Head of Passes
Plans BA, BB, BC, and BD

	<u>Base</u>	<u>Plan</u> <u>BA</u>	<u>Diff</u>	<u>Plan</u> <u>BB</u>	<u>Diff</u>	<u>Plan</u> <u>BC</u>	<u>Diff</u>	<u>Plan</u> <u>BD</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
High water	3.2	3.3	+0.1	3.3	+0.1	2.3	-0.9	2.2	-1.0
Low water	2.4	2.6	+0.2	2.6	+0.2	1.5	-0.9	1.4	-1.0
Range	0.8	0.7	-0.1	0.7	-0.1	0.8	0.0	0.8	0.0
<u>Carrollton Stage 14 ft</u>									
High water	4.3	4.3	0.0	4.2	-0.1	3.1	-1.2	3.1	-1.2
Low water	3.7	3.8	+0.1	3.6	-0.1	2.5	-1.2	2.5	-1.2
Range	0.6	0.5	-0.1	0.6	0.0	0.6	0.0	0.6	0.0
<u>Carrollton Stage 18 ft</u>									
High water	5.1	5.3	+0.2	5.2	+0.1	4.4	-0.7	4.4	-0.7
Low water	4.8	5.1	+0.3	5.1	-0.3	4.2	-0.6	4.1	-0.7
Range	0.3	0.2	-0.1	0.1	-0.2	0.2	-0.1	0.3	0.0

* Tide heights are expressed in feet mlw.

Table A20
Effects of Plans on Tide Heights* at Head of Passes
Plans BE and BF

	<u>Base</u>	<u>Plan</u> <u>BE</u>	<u>Diff</u>	<u>Plan</u> <u>BB</u>	<u>Diff</u>
<u>Carrollton Stage 14 ft</u>					
High water	4.3	3.1	-1.2	3.2	-1.1
Low water	3.7	2.6	-1.1	2.7	-1.0
Range	0.6	0.5	-0.1	0.5	-0.1
<u>Carrollton Stage 18 ft</u>					
High water	5.1	4.5	-0.6	4.4	-0.7
Low water	4.8	4.3	-0.5	4.2	-0.6
Range	0.3	0.2	-0.1	0.2	-0.1

* Tide heights are expressed in feet mlw

Table A21
Effects of Plans on Velocities* in Southwest Pass
Plan BA

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
1.5	3.3	3.1	-0.2	3.3	3.3	0.0	2.7	2.6	-0.1
3.0	3.7	4.5	+0.8	3.5	3.7	+0.2	2.7	2.9	-0.2
5.0	2.8	3.0	+0.2	2.7	2.6	-0.1	1.9	2.0	+0.1
<u>Carrollton Stage 14 ft</u>									
1.5	5.5	4.6	-0.9	5.5	4.8	-0.7	4.5	4.3	-0.2
3.0	5.3	6.5	+1.2	5.3	6.1	+0.8	4.2	4.7	+0.5
5.0	4.8	4.4	-0.4	4.3	3.8	-0.5	3.1	3.0	-0.1
<u>Carrollton Stage 18 ft</u>									
1.5	7.2	6.6	-0.6	7.4	6.8	-0.6	6.6	6.3	-0.3
3.0	7.6	9.4	+1.8	7.4	9.1	+1.7	6.0	7.6	+1.6
5.0	6.1	6.2	+0.1	5.7	5.9	+0.2	4.7	5.0	+0.3

Note: Plan BA included the addition of 13 lateral spur dikes and 4 friction chambers between miles 1.8 and 4.1 BHP.

* Velocities are in feet per second and are an average over the tidal cycle.

Table A22
Effects of Plans on Velocities* in Southwest Pass
Plan BB

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
5.0	2.8	3.0	+0.2	2.7	2.4	-0.3	1.9	1.9	0.0
7.0	3.3	2.8	-0.5	2.7	2.4	-0.3	2.1	1.9	-0.2
9.0	3.7	3.2	-0.5	3.0	2.8	-0.2	2.5	2.2	-0.3
11.0	3.1	2.9	-0.2	2.7	2.6	-0.1	2.0	2.0	0.0
<u>Carrollton Stage 14 ft</u>									
5.0	4.8	4.9	+0.1	4.3	4.0	-0.3	3.1	3.1	0.0
7.0	4.8	4.4	-0.4	4.1	3.8	-0.3	3.0	2.7	-0.2
9.0	4.8	5.2	+0.3	4.5	4.5	0.0	3.6	3.4	-0.2
11.0	5.0	5.0	0.0	4.1	4.3	+0.2	3.2	3.4	+0.2
<u>Carrollton Stage 18 ft</u>									
5.0	6.1	6.4	+0.3	5.7	5.3	-0.4	4.7	4.5	-0.2
7.0	6.1	6.4	+0.3	5.0	5.5	+0.5	3.6	4.3	+0.7
9.0	6.5	7.6	+1.1	5.9	6.9	+1.0	4.3	5.6	+1.3
11.0	6.9	7.3	+0.4	6.2	6.5	+0.3	4.5	4.8	+0.3

Note: Plan BB included the addition of 2 lateral spur dikes and 3 friction chambers between miles 5.5 and 8.1 BHP plus the elements of Plan BA.

* Velocities are in feet per second and are an average over the tidal cycle.

Table A23
Effects of Plans on Velocities* in Southwest Pass
Plan BC

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
9.0	3.7	3.1	-0.6	3.0	2.6	-0.4	2.5	2.0	-0.5
11.0	3.1	3.4	+0.3	2.7	2.9	+0.2	2.0	2.3	+0.3
12.0	3.8	3.0	-0.8	3.1	2.7	-0.4	2.2	2.1	-0.1
15.0	2.9	2.8	-0.1	2.4	2.4	0.0	2.1	2.0	-0.1
<u>Carrollton Stage 14 ft</u>									
9.0	4.9	5.4	+0.5	4.5	4.8	+0.3	3.6	4.0	+0.4
11.0	5.0	4.8	-0.2	4.1	4.4	+0.3	3.2	3.1	-0.1
12.0	5.1	4.9	-0.2	4.5	4.6	+0.1	3.7	3.6	-0.1
15.0	4.4	5.0	+0.6	4.0	4.5	+0.5	3.2	3.4	+0.2
<u>Carrollton Stage 18 ft</u>									
9.0	6.5	7.3	+0.8	5.9	6.8	+0.9	4.3	5.7	+1.4
11.0	6.9	6.7	-0.2	6.2	6.1	-0.1	4.5	4.7	+0.2
12.0	7.1	7.2	+0.1	6.6	6.3	-0.3	5.3	5.3	0.0
15.0	6.4	7.1	+0.7	5.9	6.3	+0.4	4.7	4.7	0.0

Note: Plan BC included the addition of 17 lateral spur dikes and 6 friction chambers between miles 9.8 and 12.5 BHP plus the elements of Plans BA and BB.

* Velocities are in feet per second and are an average over the tidal cycle.

Table A24
Effects of Plans on Velocities* in Southwest Pass
Plan BD

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 10 ft</u>									
11.0	3.1	3.3	+0.2	2.7	2.8	+0.1	2.0	2.0	0.0
12.0	3.8	3.1	-0.7	3.1	2.9	-0.2	2.2	2.4	+0.2
15.0	2.9	3.0	+0.1	2.4	2.6	+0.2	2.1	1.9	-0.2
17.0	3.0	3.4	+0.4	2.4	2.7	+0.3	1.3	1.8	+0.5
<u>Carrollton Stage 14 ft</u>									
11.0	5.0	5.3	+0.3	4.1	4.6	+0.5	3.2	3.5	+0.3
12.0	5.1	5.3	+0.2	4.5	4.8	+0.3	3.7	4.0	+0.3
15.0	4.4	4.5	+0.1	4.0	4.3	+0.3	3.2	3.3	+0.1
17.0	4.3	5.5	+1.2	4.0	4.7	+0.7	2.7	3.8	+1.1
<u>Carrollton Stage 18 ft</u>									
11.0	6.9	7.4	+0.5	6.2	6.3	+0.1	4.5	5.0	+0.5
12.0	7.1	7.1	0.0	6.6	6.8	+0.2	5.3	5.5	+0.2
15.0	6.4	7.1	+0.7	5.9	6.5	+0.6	4.7	4.6	-0.1
17.0	6.6	7.5	+0.9	5.8	6.8	+1.0	4.6	5.9	+1.3

Note: Plan BD included the addition of 17 lateral spur dikes and 8 friction chambers between miles 12.5 and 17.0 BHP plus the elements of Plans BA, BB, and BC.

* Velocities are in feet per second and are an average over the tidal cycle.

Table A25
Effects of Plans on Velocities* in Southwest Pass
Plan BE

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 14 ft</u>									
11.0	5.0	5.4	+0.4	4.1	4.9	+0.8	3.2	3.5	+0.3
12.0	5.1	5.2	+0.1	4.5	4.5	0.0	3.7	3.5	-0.2
15.0	4.4	4.6	+0.2	4.0	4.0	0.0	3.2	3.2	0.0
17.0	4.3	5.2	+0.9	4.0	4.8	+0.8	2.7	3.6	+0.9
<u>Carrollton Stage 18 ft</u>									
11.0	6.9	7.2	+0.3	6.2	6.3	+0.1	4.5	4.7	+0.2
12.0	7.1	6.7	-0.4	6.6	6.1	-0.5	5.3	4.8	-0.5
15.0	6.4	5.9	-0.5	5.9	5.2	-0.7	4.7	4.5	-0.2
17.0	6.6	7.0	+0.4	5.8	6.1	+0.3	4.6	4.6	0.0

Note: Plan BE included the extension of all the dikes in Southwest Pass from miles 1.8 to 19.3 BHP to reduce the effective width between the dikes from approximately 1,420 to 1,200 ft.

* Velocities are in feet per second and are an average over the tidal cycle.

Table A26
Effects of Plans on Velocities* in Southwest Pass
Plan BF

<u>Mile</u>	<u>Surface</u>			<u>Middepth</u>			<u>Bottom</u>		
	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>	<u>Base</u>	<u>Plan</u>	<u>Diff</u>
<u>Carrollton Stage 14 ft</u>									
11.0	5.0	5.3	+0.3	4.1	4.5	+0.4	3.2	3.1	-0.1
12.0	5.1	5.4	+0.3	4.5	5.1	+0.6	3.7	4.3	+0.6
15.0	4.4	5.7	+1.3	4.0	5.3	+1.3	3.2	4.4	+1.2
17.0	4.3	5.6	+1.3	4.0	4.9	+0.9	2.7	4.0	+1.3
<u>Carrollton Stage 18 ft</u>									
11.0	6.9	7.4	+0.5	6.2	6.2	0.0	4.5	4.5	0.0
12.0	7.1	7.7	+0.6	6.6	7.3	+0.7	5.3	5.4	+0.1
15.0	6.4	7.6	+1.2	5.9	7.0	+1.1	4.7	5.6	+0.9
17.0	6.6	7.7	+1.1	5.8	6.9	+1.1	4.6	5.6	+1.0

Note: Plan BF included the extension of all the dikes in Southwest Pass from miles 1.8 to 19.3 BHP to reduce the effective width between the dikes from approximately 1,200 to 1,000 ft.

* Velocities are in feet per second and are an average over the tidal cycle.

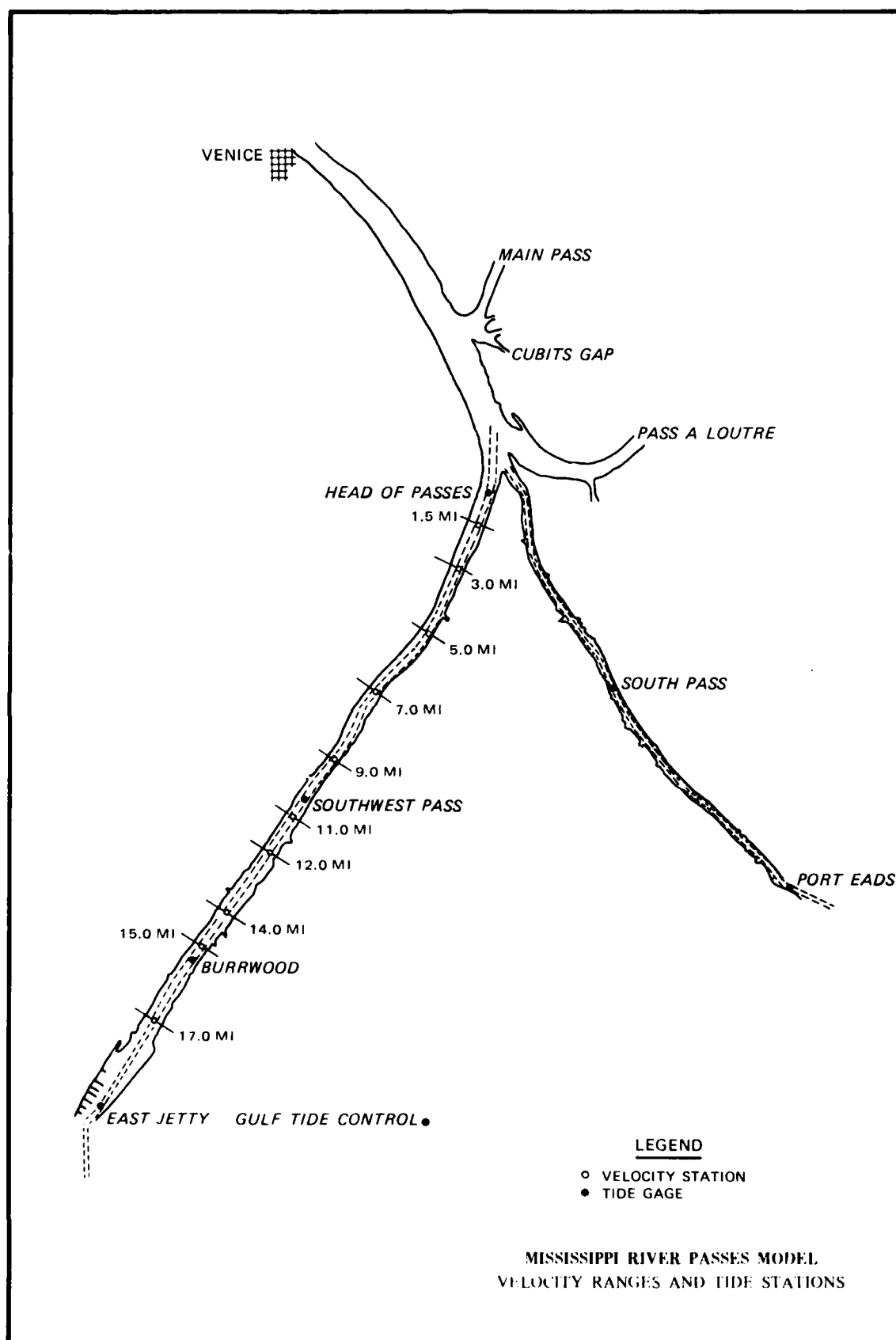
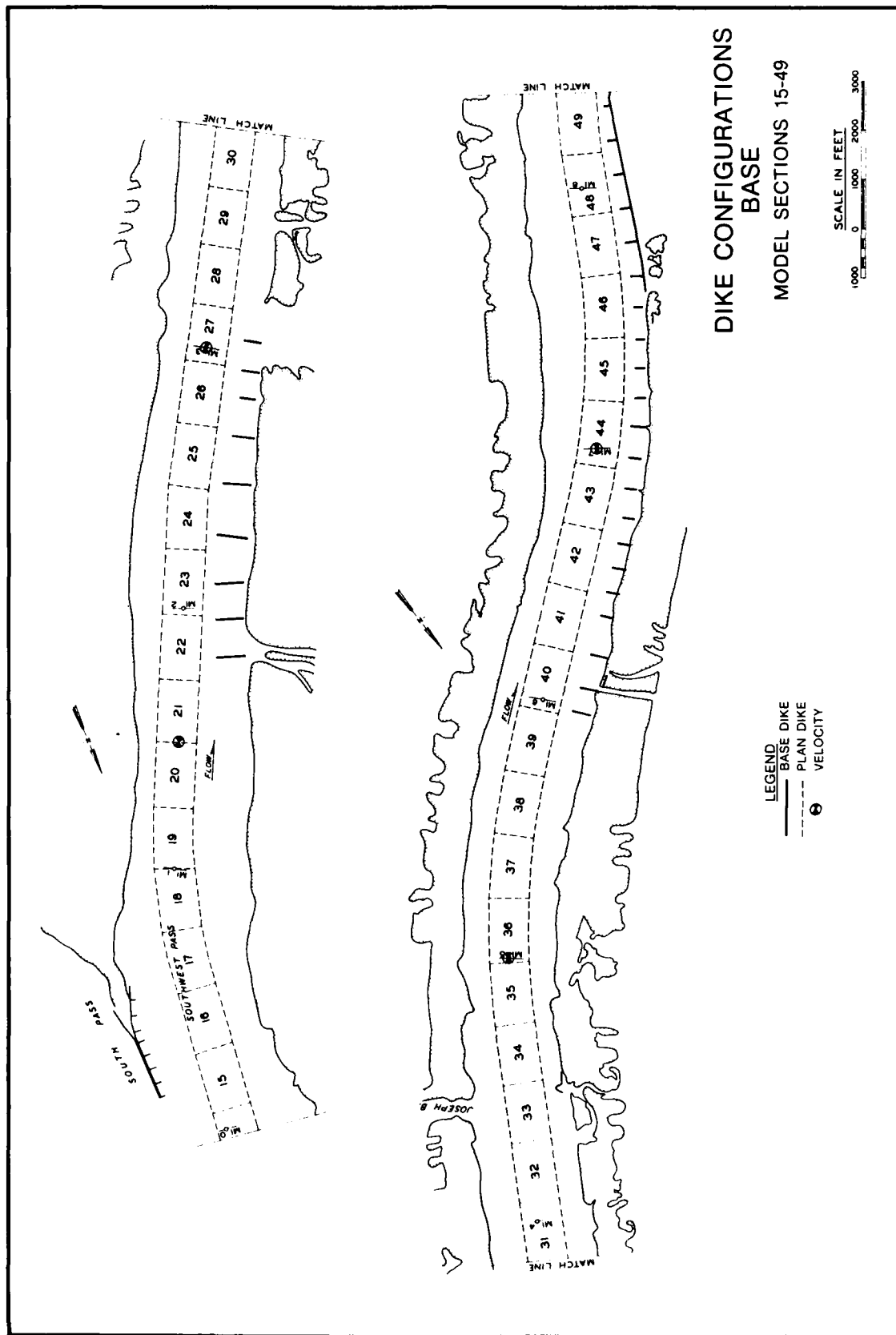


PLATE A2



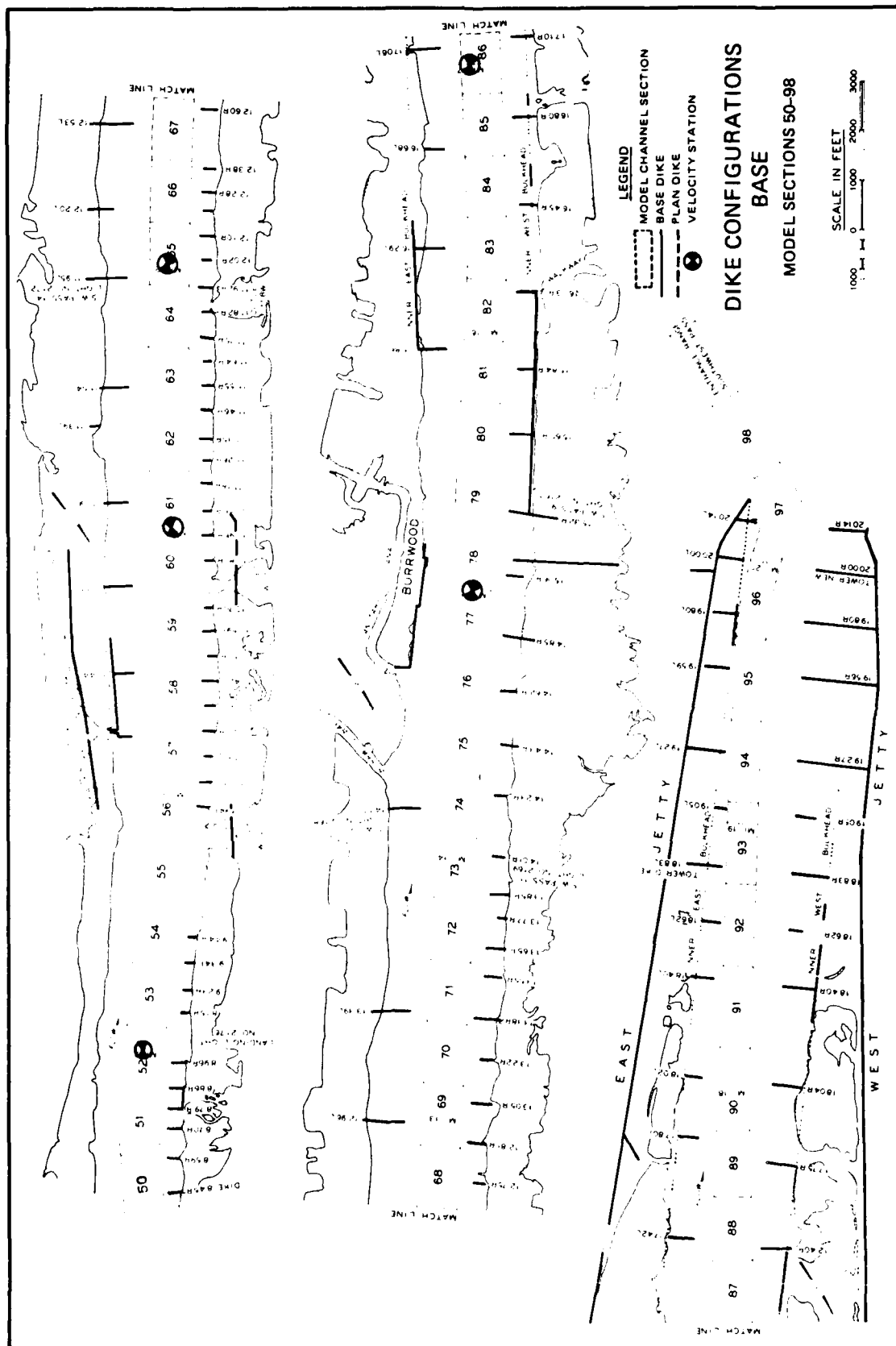
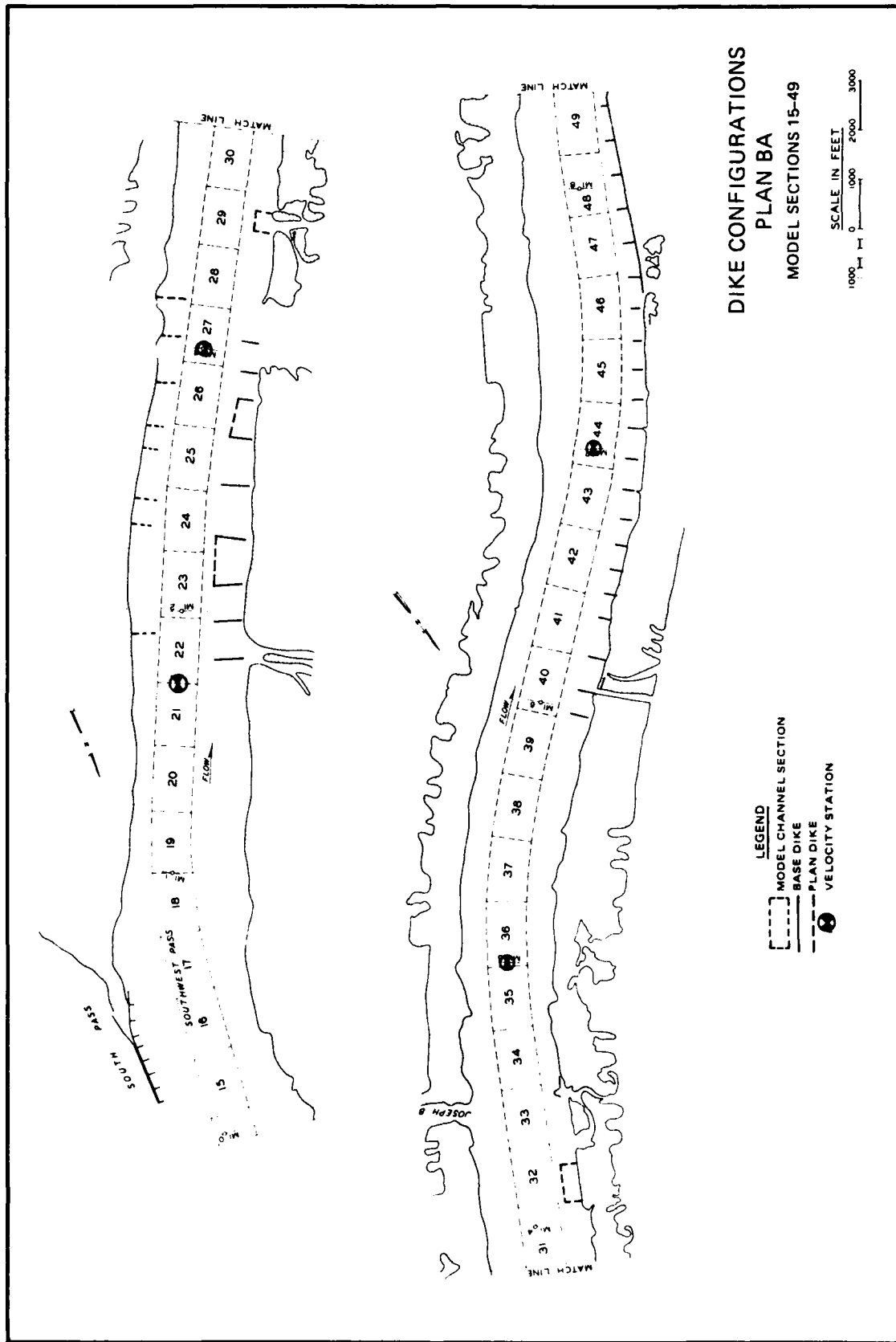


PLATE A3

PLATE A4





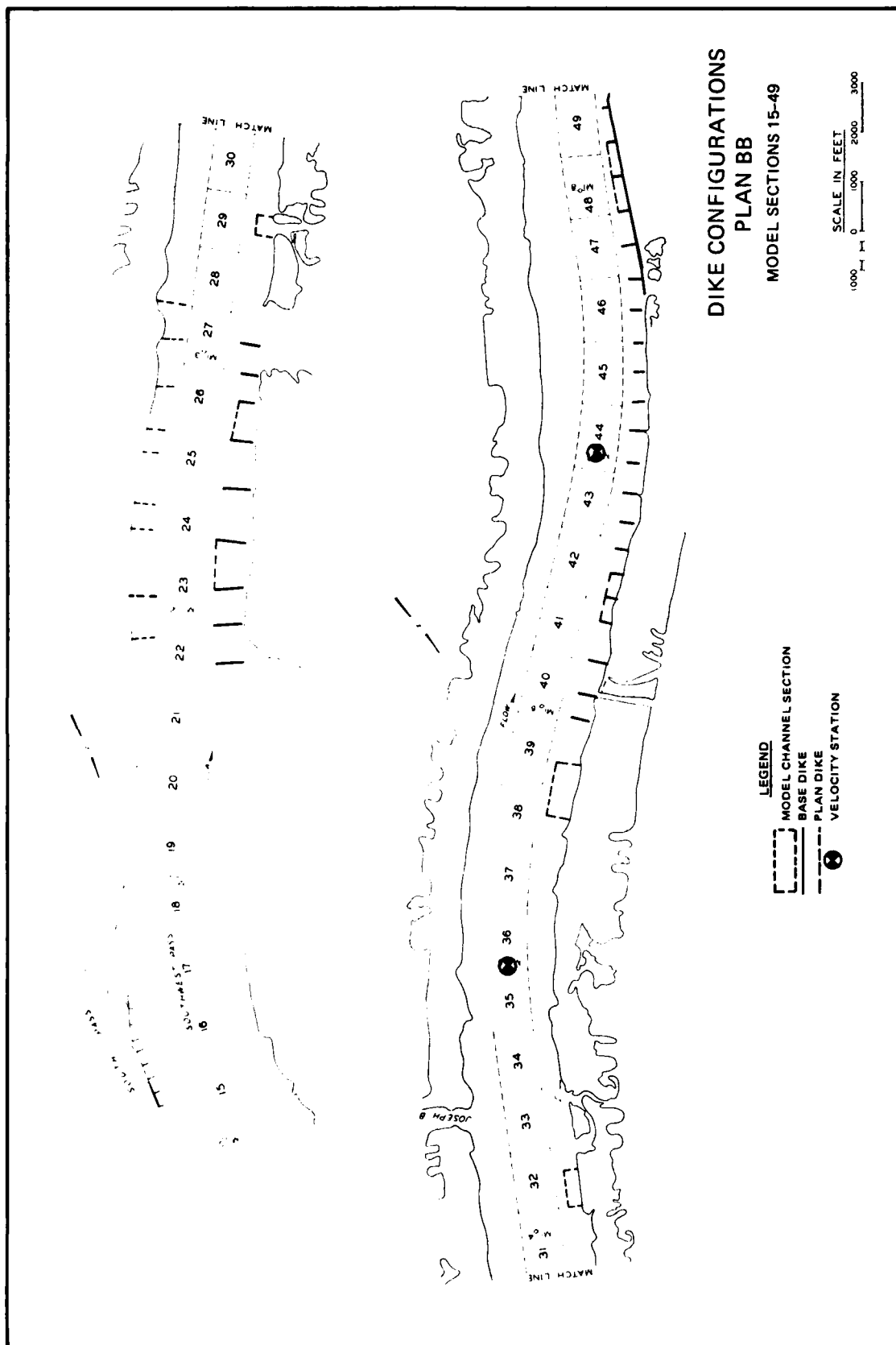
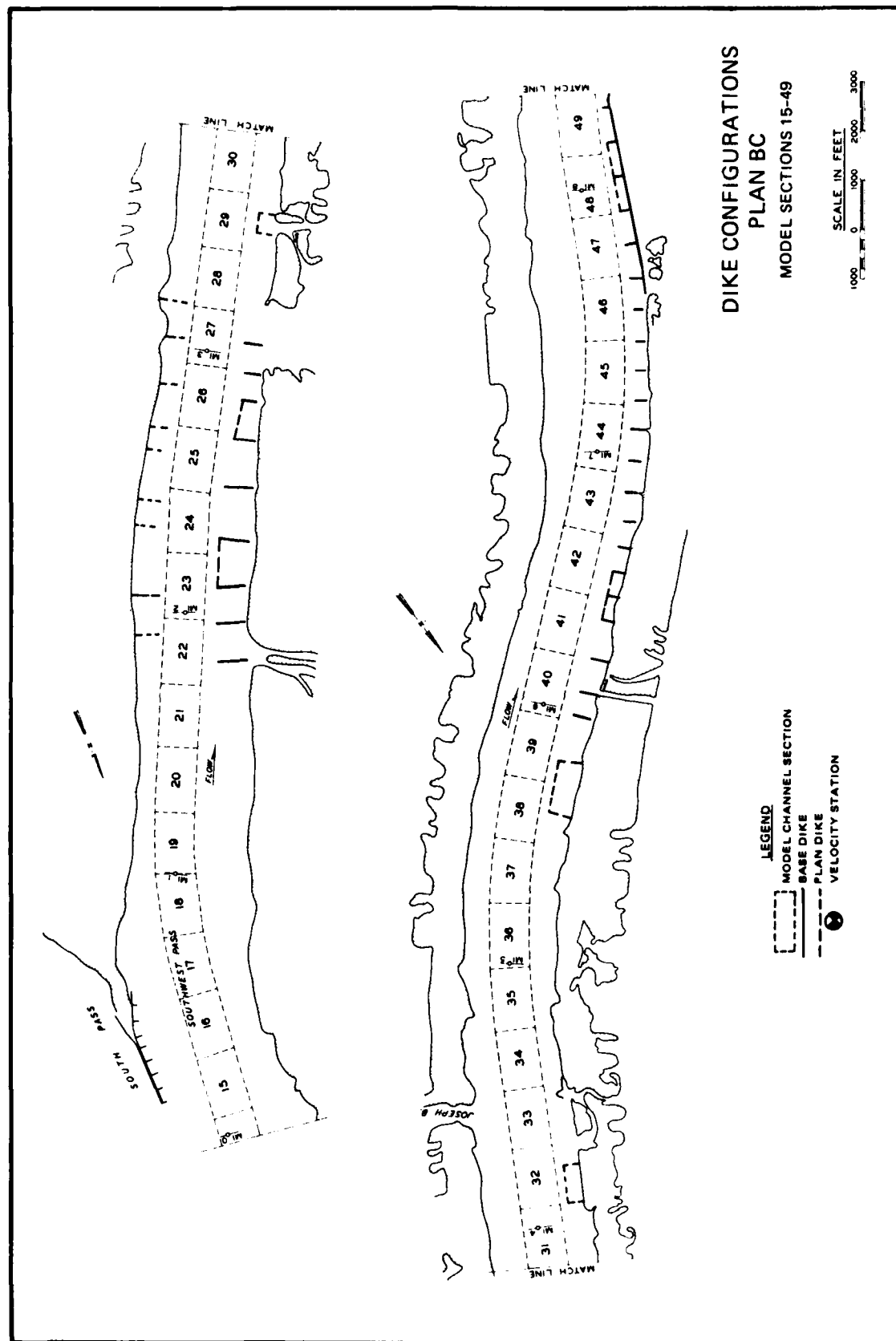




PLATE A8



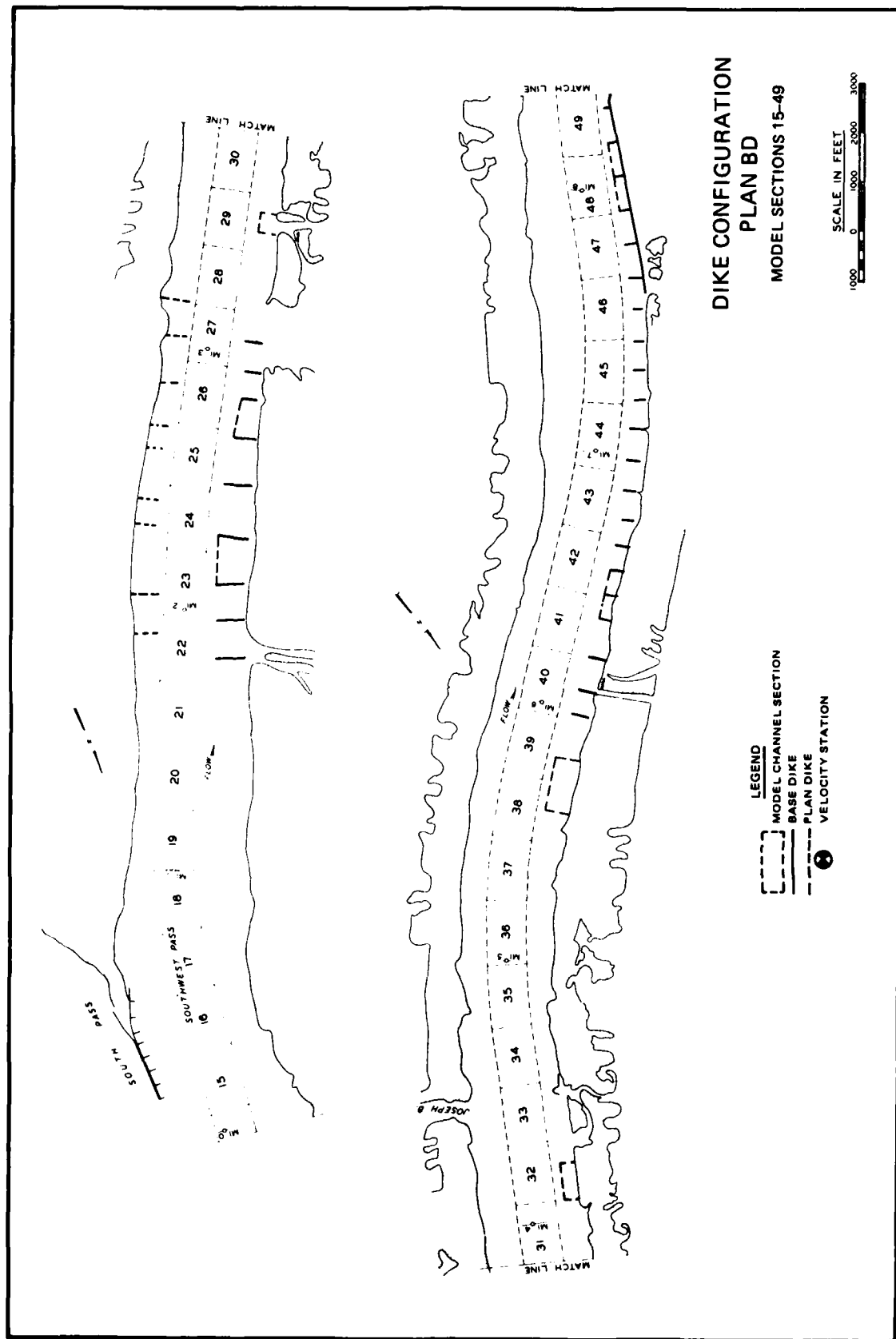
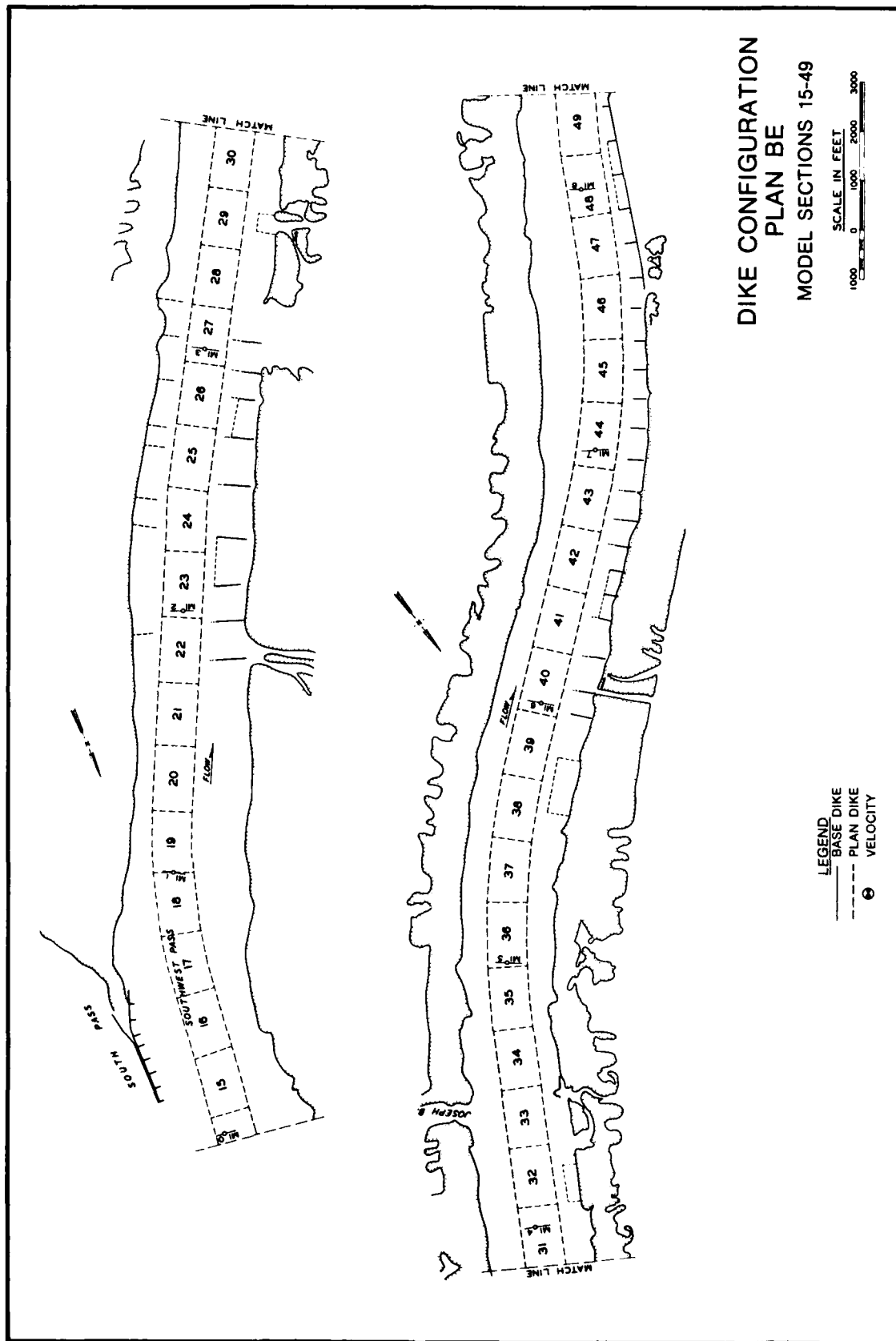
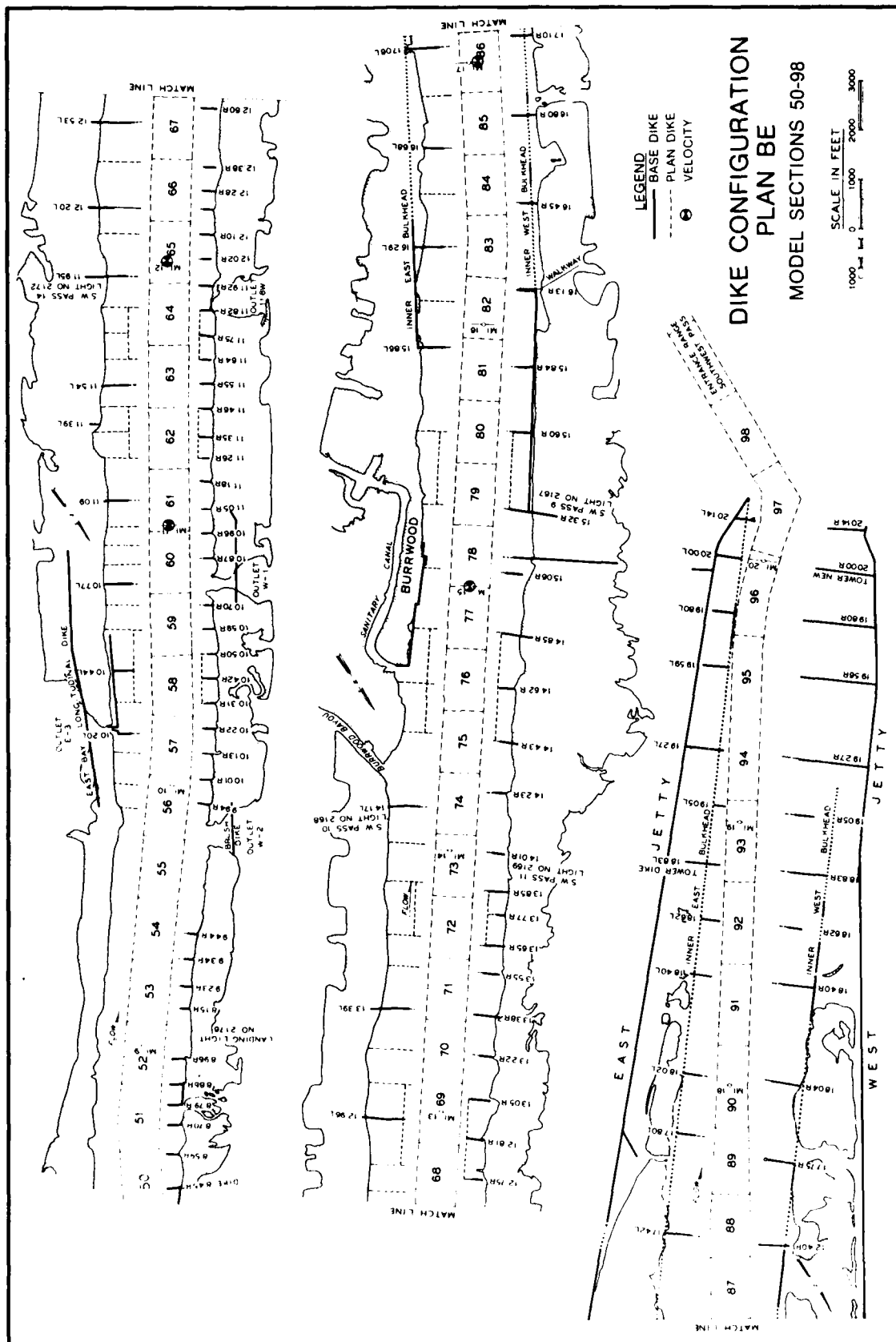
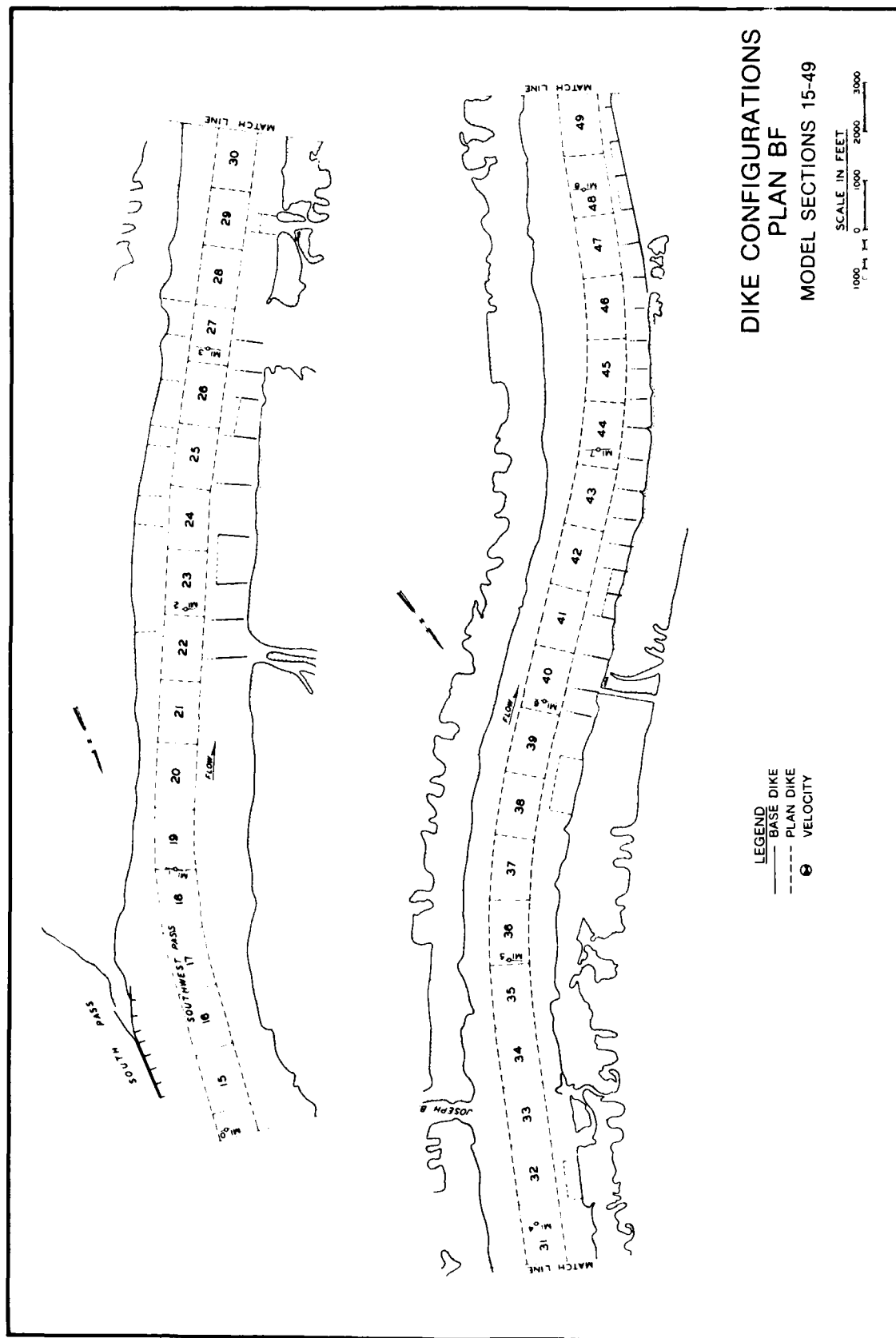


PLATE A12







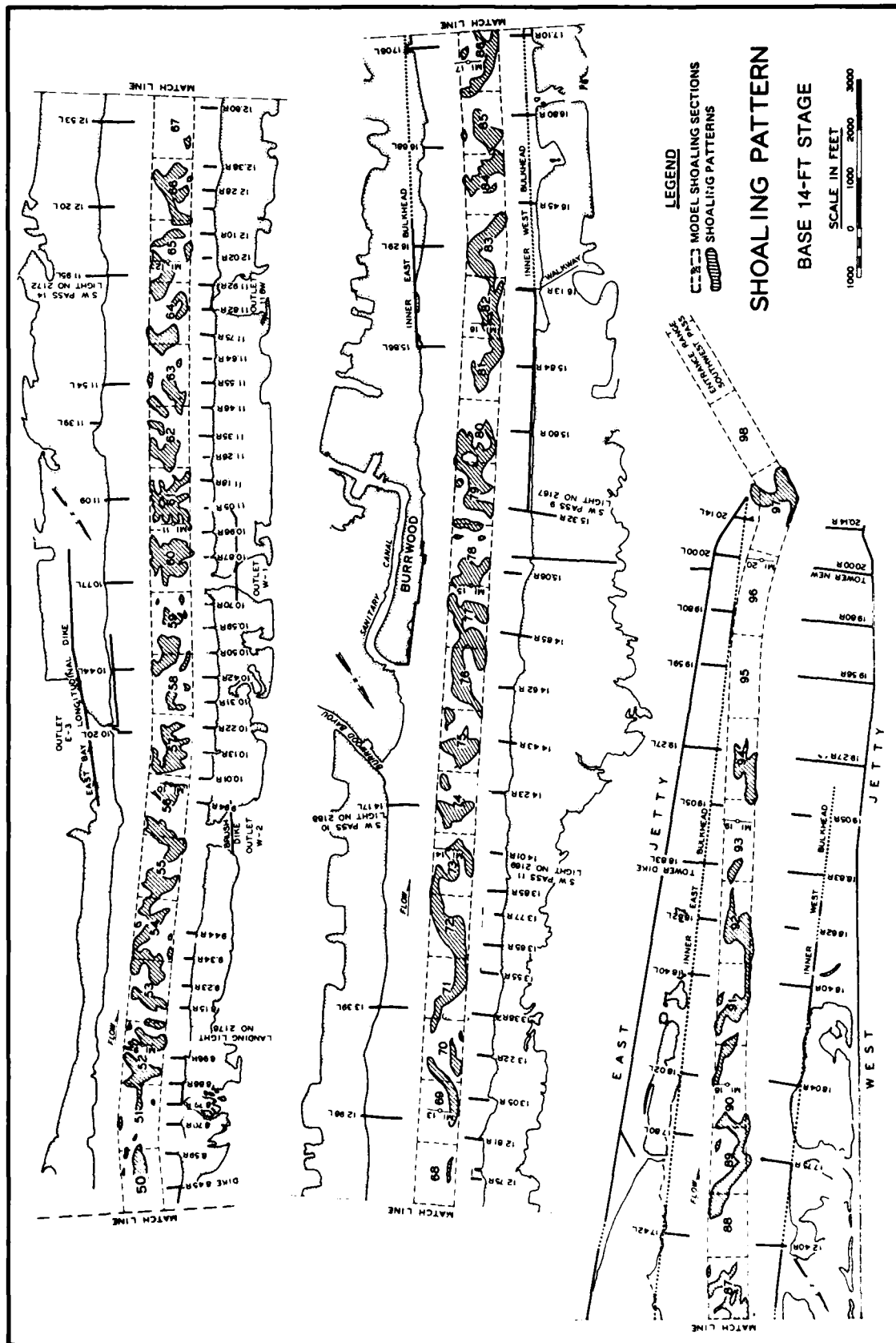


PLATE A17

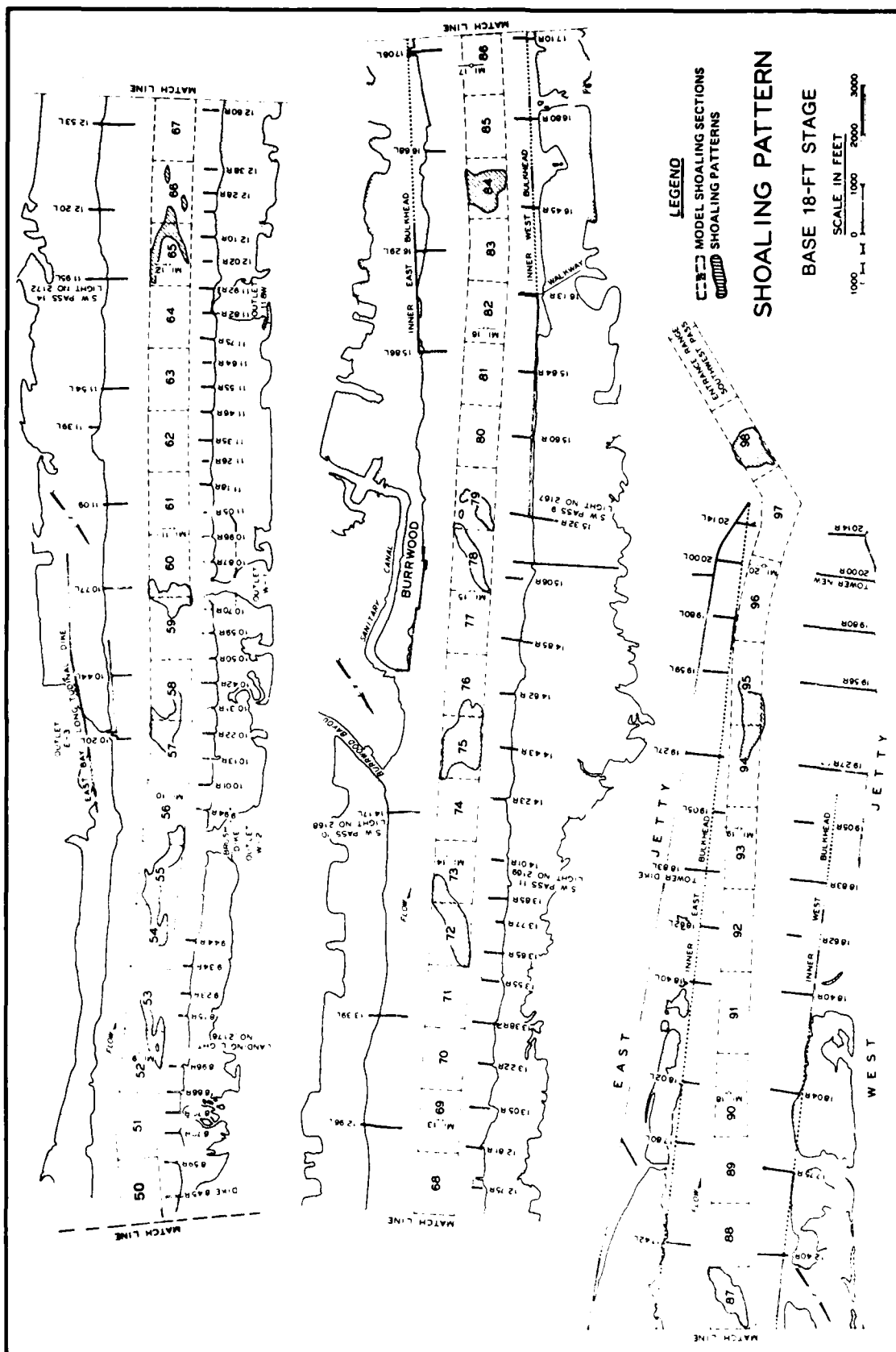


PLATE A18

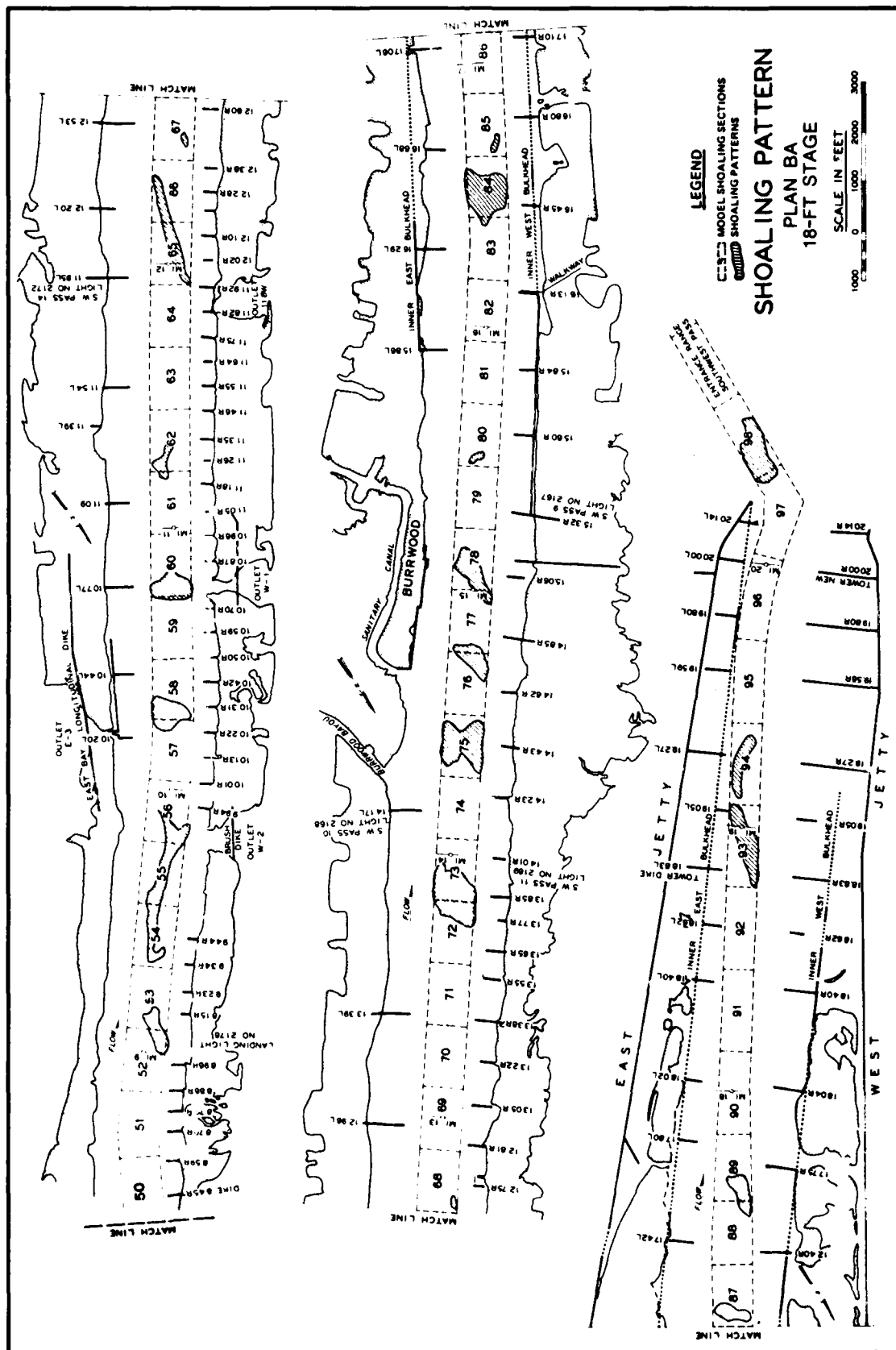
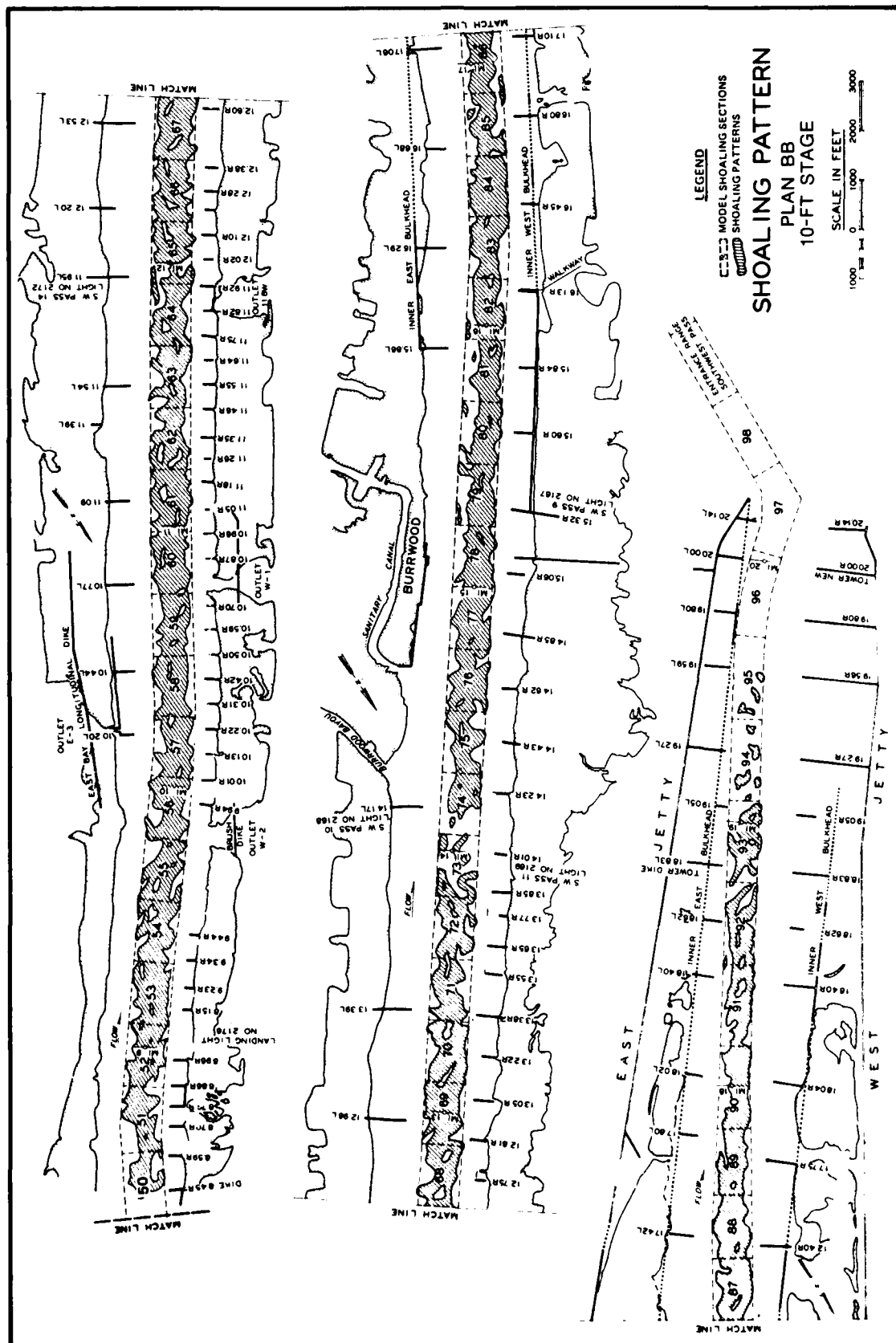
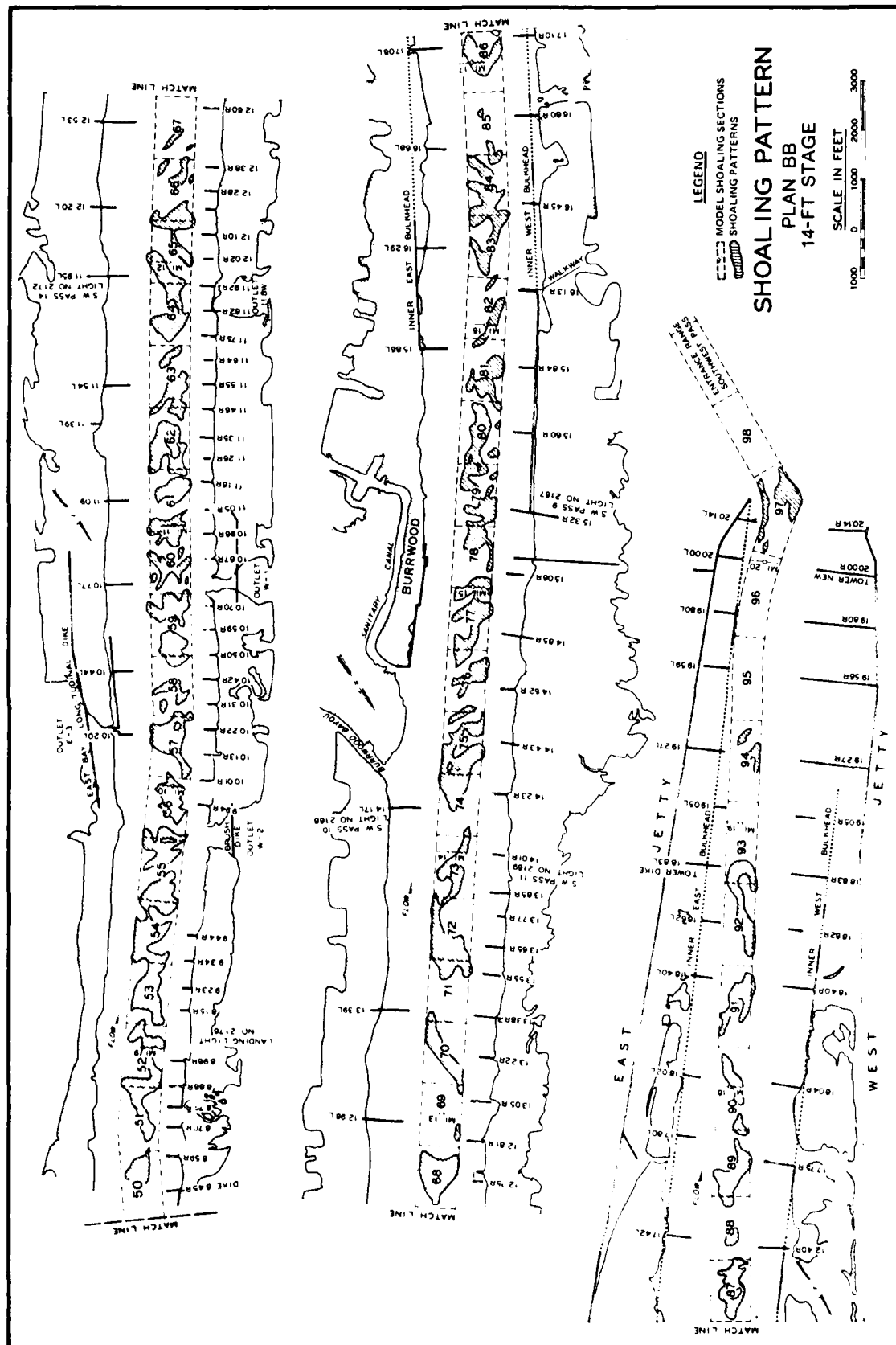
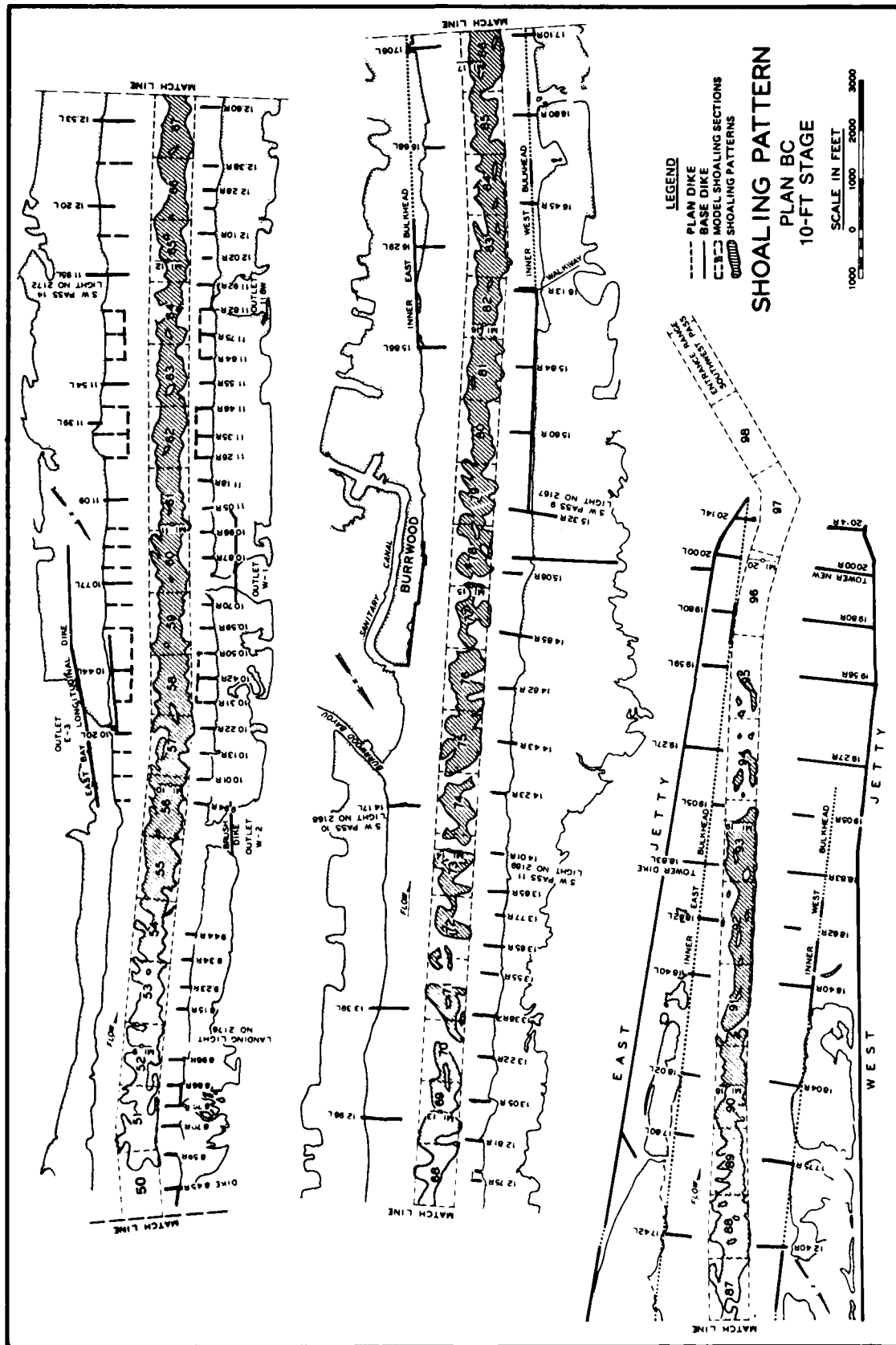
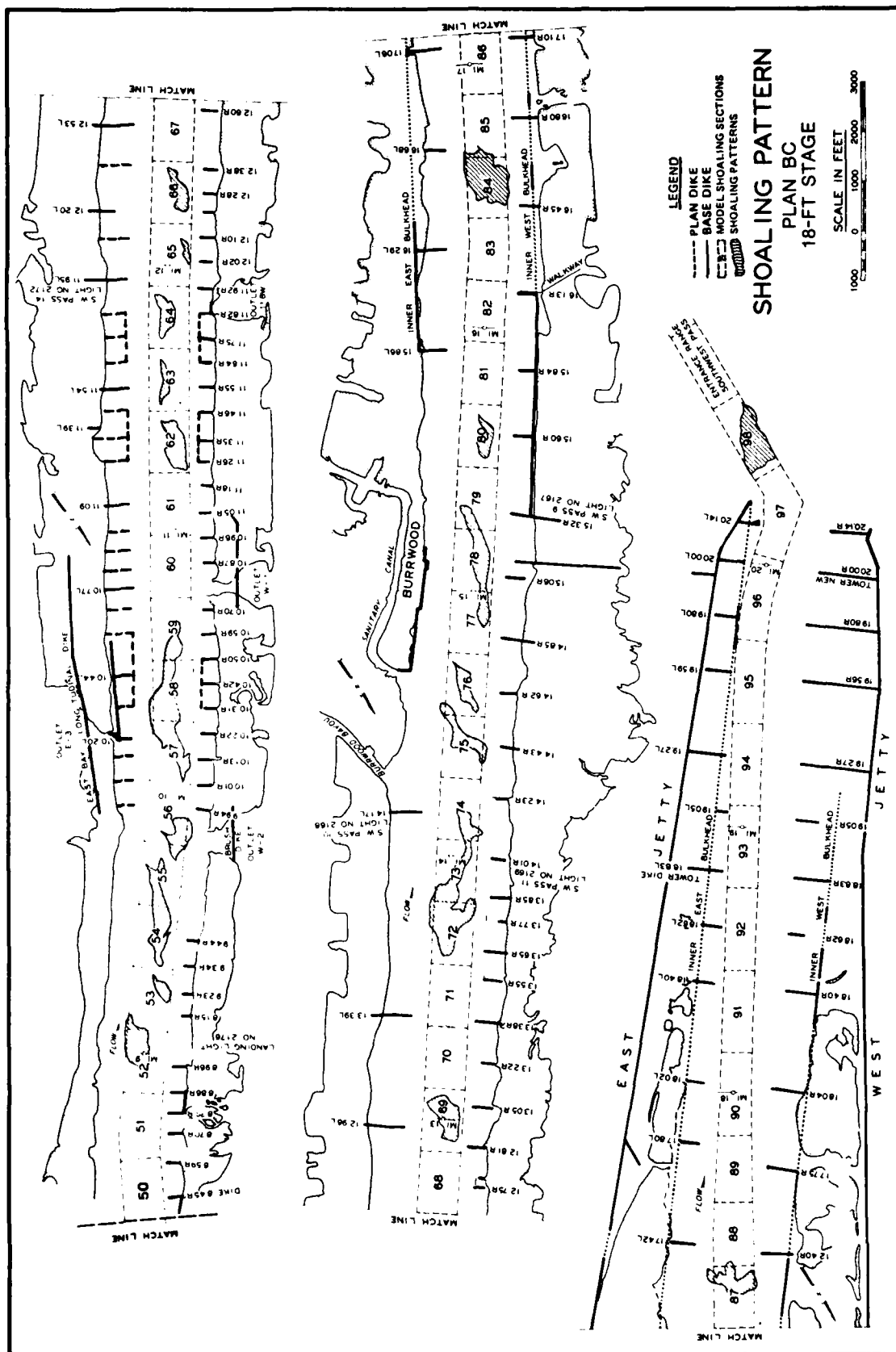


PLATE A21









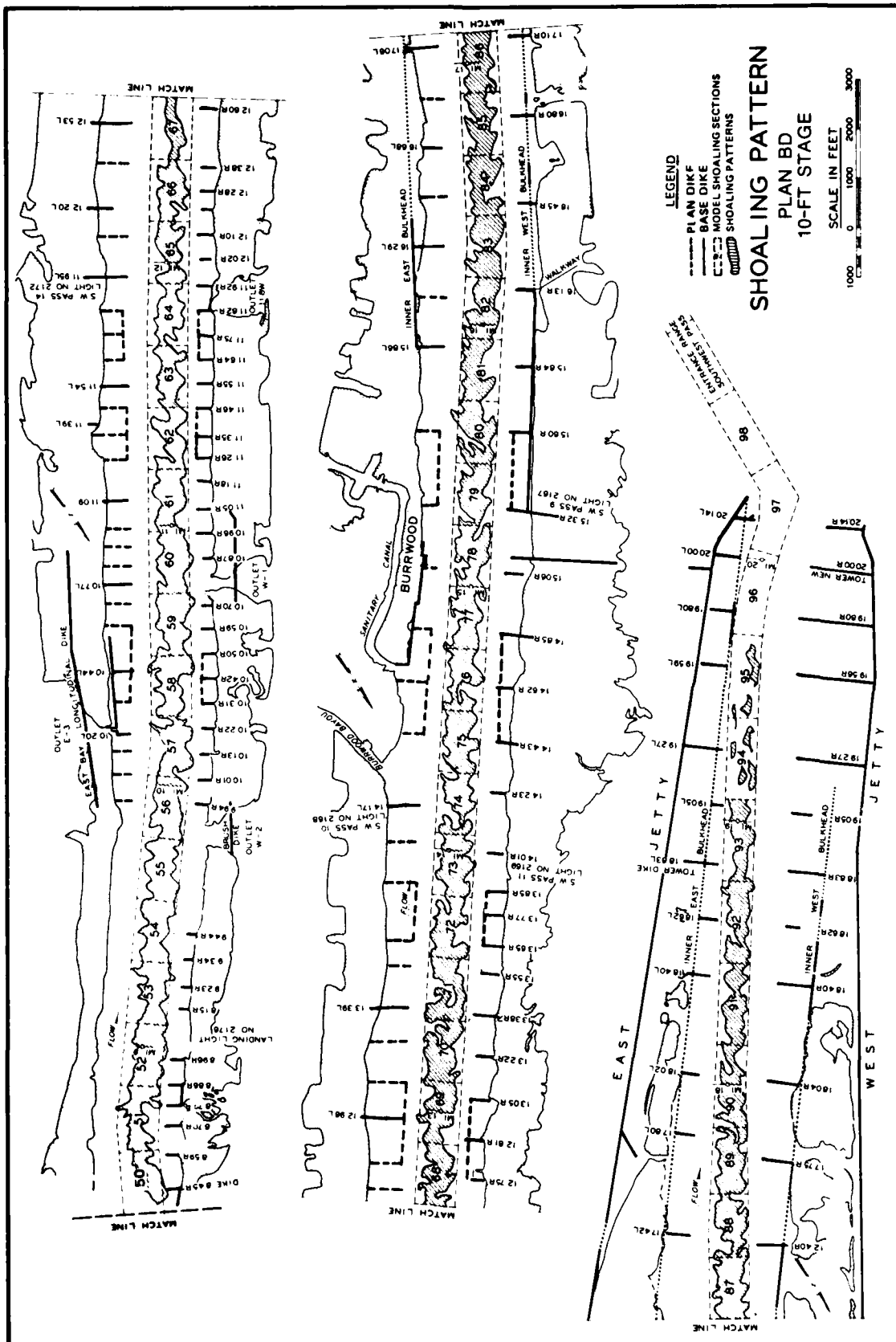
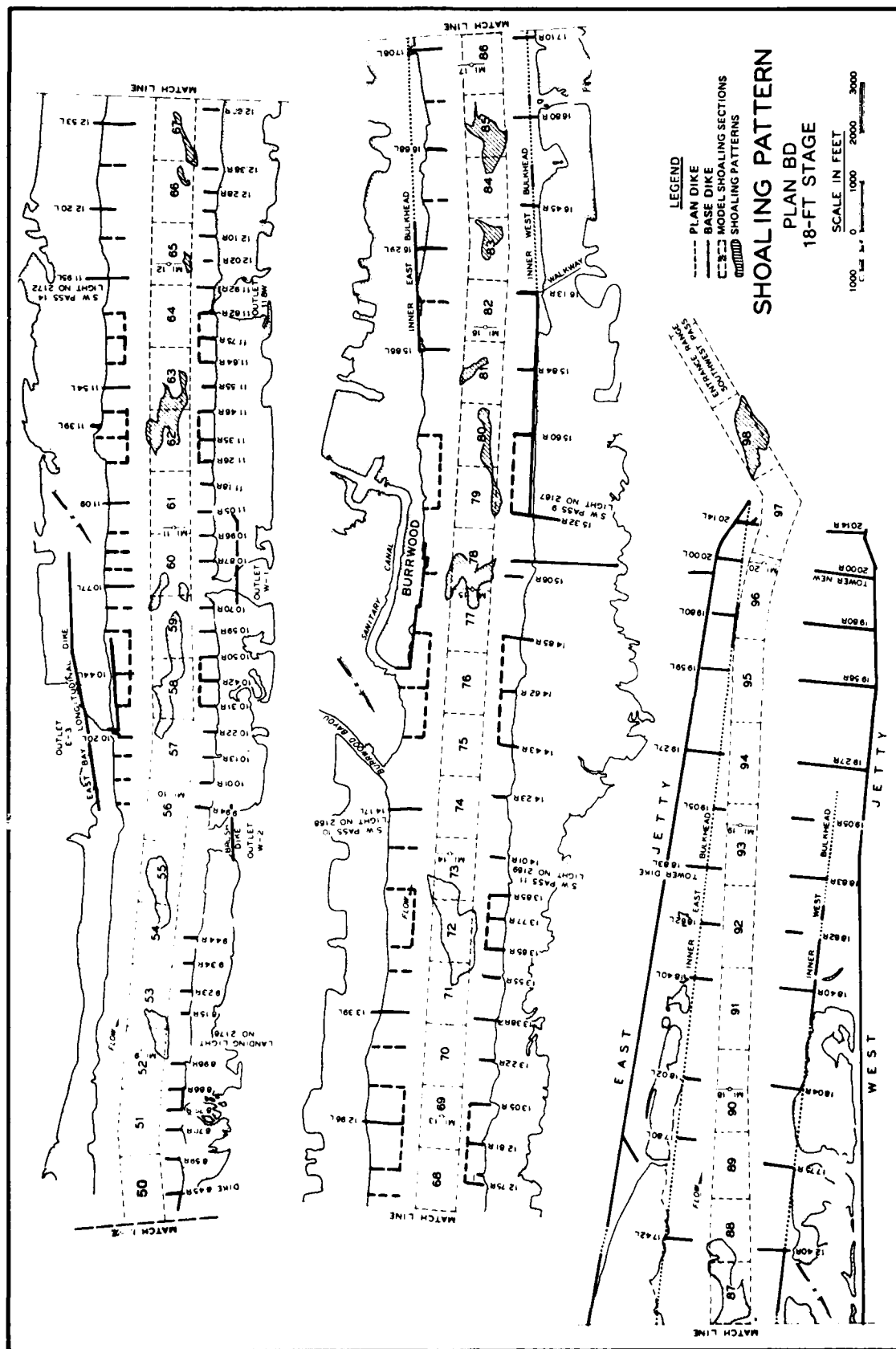


PLATE A28





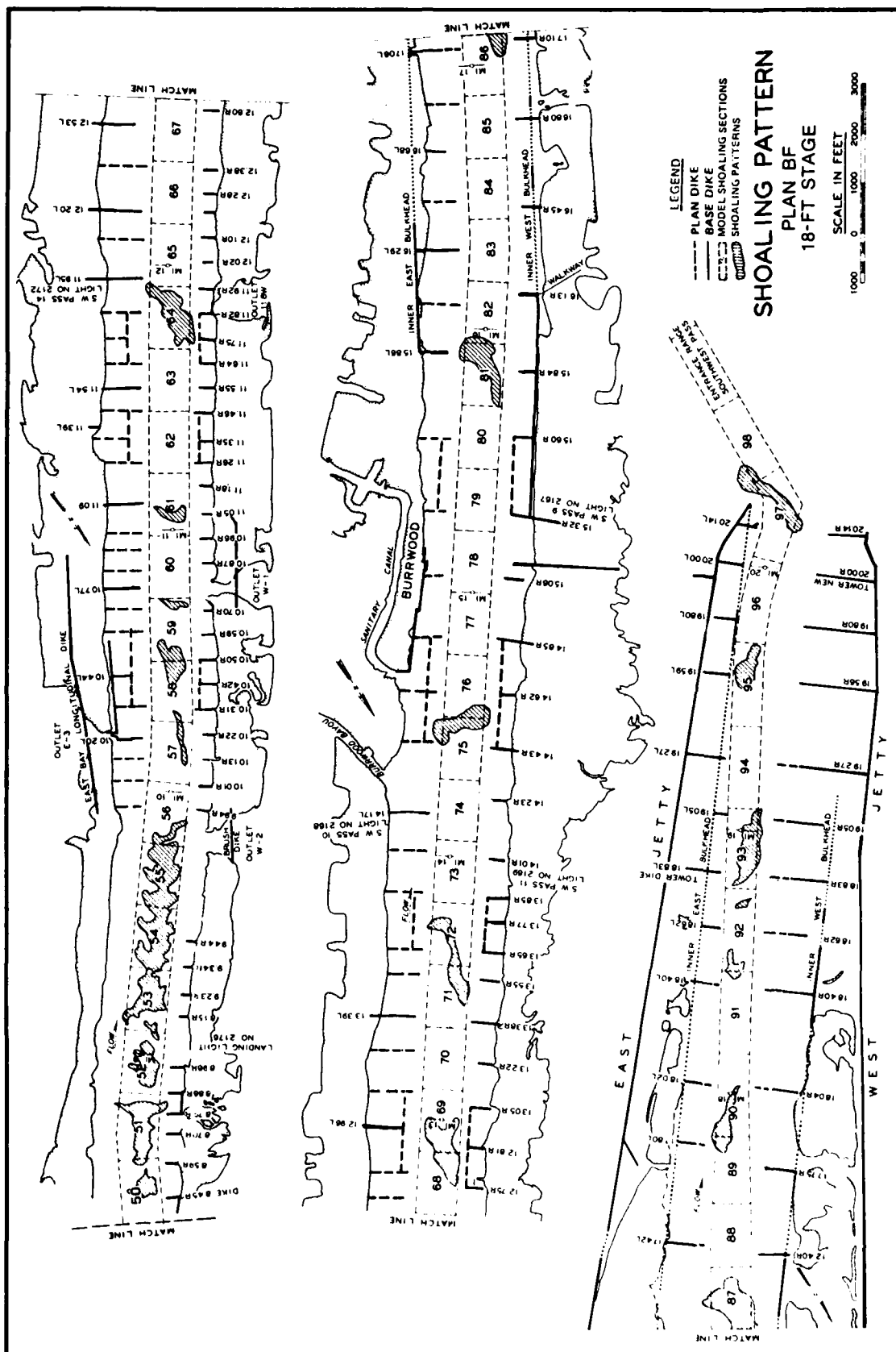


PLATE A34

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